TECHNOLOGY

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A FAWCETT MAGAZINE

SEPTEMBER
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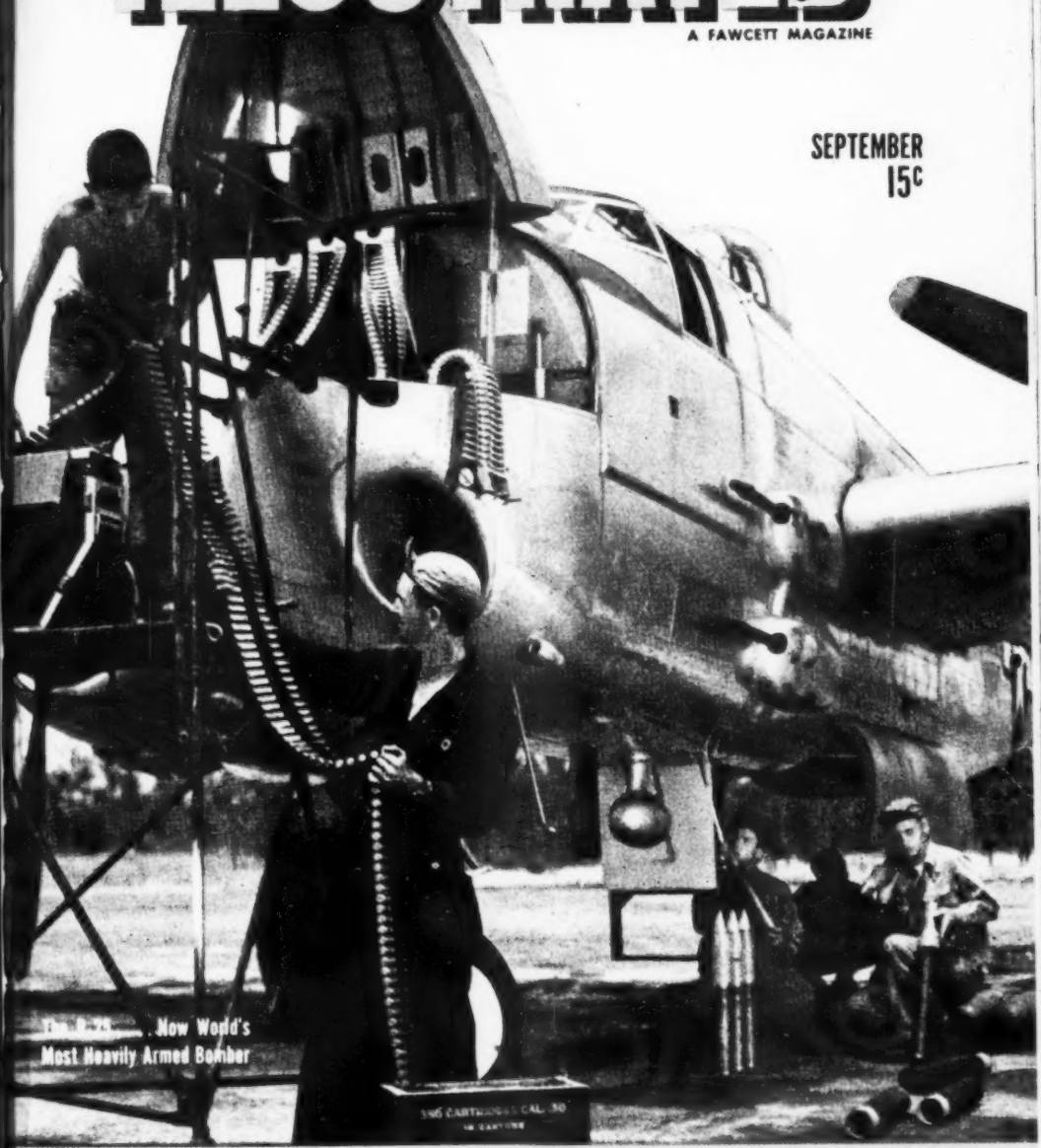
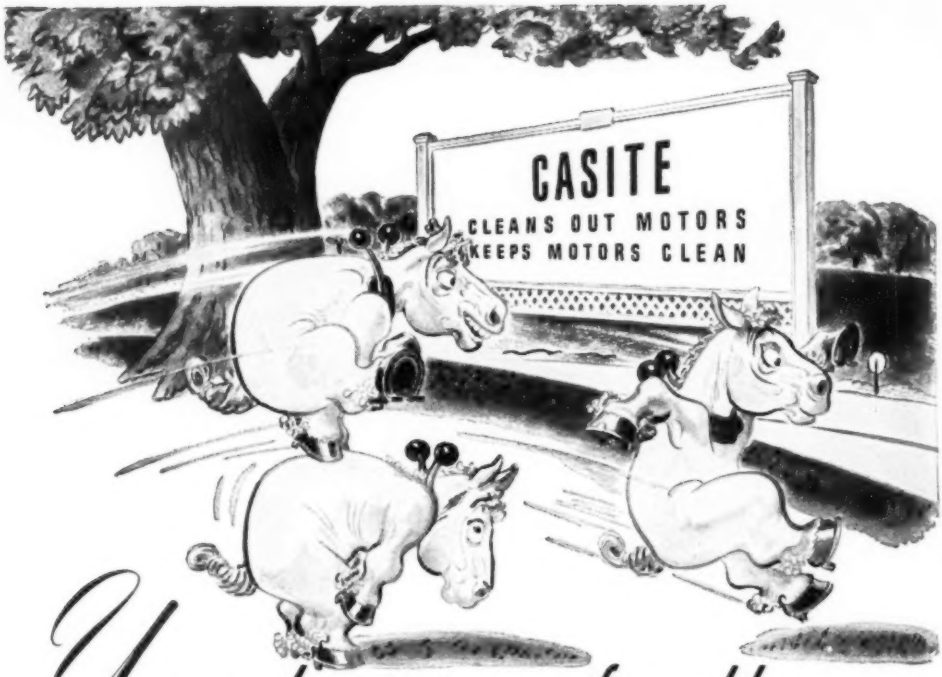


NEW MAGIC WITH OLD FURNITURE



Young horsepower for old cars

Ever see the inside of your motor? Well, it's a maze of little pipes and passages that choke up with power-destroying sludge and gum. You can clean these out, and keep them clean, with Casite.

Better and Smoother Performance or Double-Your-Money-Back

It's as simple as that. Either your motor runs better and smoother, or you get back *twice* what you paid. Used through the carburetor, Casite gives an effective tune-up at low cost. Added to the crankcase oil, it stays on the job from one oil change to another.

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Guarantee

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at Home in Spare Time to
TECHNICIAN

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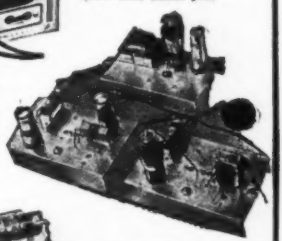

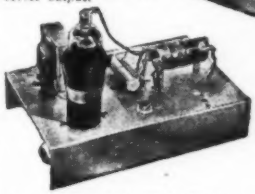

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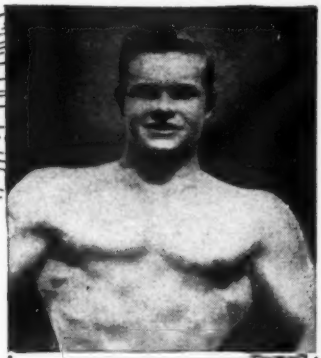
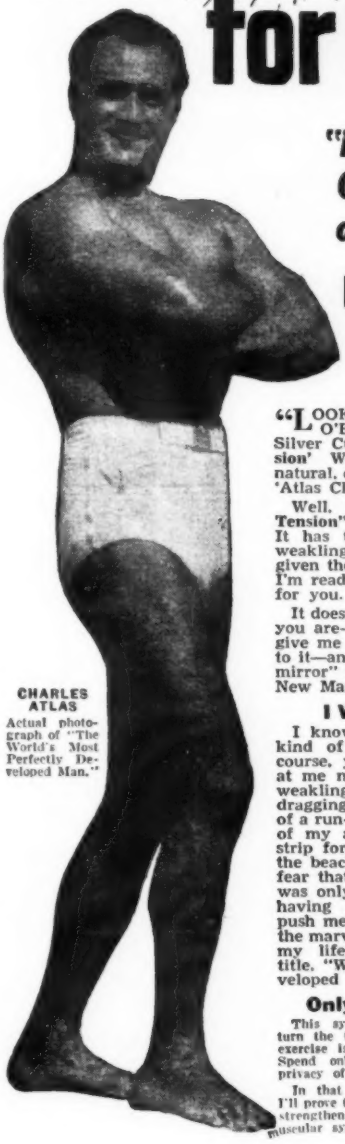


J. G. O'BRIEN.
Atlas Champion Cup Winner
This is an ordinary snap-shot of one of Charles Atlas' California pupils.



CHARLES ATLAS
Actual photograph of "The World's Most Perfectly Developed Man."

"I've Made New Men Out of Thousands of Other Fellows..."

HERE'S WHAT I DID FOR J. G. O'BRIEN... AND WHAT I CAN DO FOR YOU!"

—Charles Atlas

"LOOK at me NOW!" writes J. G. O'Brien of California, one of my Silver Cup Winners. "'**Dynamic Tension**' WORKS! I'm proud of the natural, easy way you have made me an 'Atlas Champion'!"

Well, I'M proud of my "**Dynamic Tension**" system too! And no wonder! It has turned thousands of scrawny weaklings into powerful HE-MEN—has given them NEW bodies for OLD ones! I'm ready to prove it can do the same for you.

It doesn't matter how frail and skinny you are—or how fat and flabby! Just give me 15 minutes a day and I'll hop to it—and give you real "look-in-your-mirror" proof that YOU can become a New Man!

I Was a 97-lb. Weakling

I know what it means to have the kind of body that people pity! Of course, you wouldn't know it to look at me now, but I was once a skinny weakling who weighed only 97 lbs.—dragging myself around like the hands of a run-down clock. I was so ashamed of my appearance that I didn't dare strip for gym or show myself on the beach in a pair of trunks, for fear that people would laugh! It was only after I got fed up with having bigger, stronger fellows push me around that I discovered the marvelous system that changed my life—and won for me the title, "World's Most Perfectly Developed Man."

Only 15 Minutes a Day

This system—"**Dynamic Tension**"—will turn the trick for you. No **theory**—every exercise is **practical**. And, man, so **easy**! Spend only 15 minutes a day in the privacy of your own home.

In that little bit of your spare time, I'll prove that I can broaden your shoulders, strengthen your back, develop your whole muscular system INSIDE and OUTSIDE!

I can add inches to your chest, give you a vise-like grip, make those legs of yours lithe and powerful. I can shoot new strength into your old backbone, exercise those inner organs, help you cram your body so full of pep, vigor and red-blooded vitality that you won't feel there's even "standing room" left for weakness and that lazy feeling! Before I get through with you I'll have your whole frame "measured" to a nice, new, beautiful suit of muscle!

And all this WITHOUT any gadgets or contraptions of any kind. When you develop your strength through "**Dynamic Tension**" you can laugh at **artificial** muscle-makers. You simply utilize the HIDDEN muscle power in your own God-given body—watch it increase and multiply double-quick into real, solid LIVE MUSCLE.

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I want the proof that your system of "**Dynamic Tension**" will help make a New Man of me—give me a healthy, husky body and big muscular development. Send me your free book, "Everlasting Health and Strength."

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YOUR INVENTION CLINIC

Conducted by

JOSEPH H. KRAUS

Mr. Kraus has been giving advice to inventors for more than 20 years. He will attempt to answer as many letters from inventors as possible in his column each month. Mr. Kraus will "call his shots as he sees them" in this column. Thoroughly versed on inventions and inventions procedure, he will never, under any circumstances, disclose any valuable secrets. He cannot answer questions relating to patent law. For such information, the Editors suggest you communicate with any one of the patent attorneys who advertise in MECHANIX ILLUSTRATED.

Can You Solve It?

Martin Lamey of Newburgh, New York, writes that he does a lot of stream fishing in fast waters for which he uses hip-boots because a bad foot prevents the use of waders. For the boots he uses a pair of sandals but the calks of the sandals give a lot of trouble. Rubber or other studs wear rapidly. Skid chains wear smooth after five hours. He offers several suggestions for removable studs but admits that these probably are not the right answer.

ANSWER: *Here is an opportunity for some invention-minded readers to aid fishermen, hikers, mountain climbers, dock-workers and the like. Develop some sort of a device, attachment or footgear, which will prevent skidding on wet surfaces, which will not wear too freely and which can be replaced quickly, even when operating at zero Fahrenheit temperatures.*

Perhaps a carborundum insert would give the needed bite, but how to lock it in place and remove it easily remains to be solved.

Gas Saving Carburetor

Paul J. Seyffer, Healdsburg, California, takes us to task for our reply to a recent correspondent. He states "Some one in Canada developed a carburetor which, when installed on any car you could obtain 100 miles to the gallon. The article never hit the market because one of the big oil companies bought it and scrapped all plans and blueprints."

ANSWER: *The statements made in your communication regarding the gas-saving carburetor do not modify our original statement. If what you say is true, then in eleven more years, the invention about which you speak will become public property and anyone can make and sell the item.*

Eleven years is not a long time in the life of a gasoline producing company. And, if such economy were possible, don't you suppose it would be put into practice immediately?

You must remember that the gasoline manufacturing organizations were responsible for the introduction of the new, high-test aviation gas. This will be made available to all motorists after the war and will give more mileage to the gallon. Also, higher compression motors will do likewise. Such developments have taken place at great expense to motorcar and gasoline producers.

There are times when devices are advertised under much glorified claims. Later these articles are removed from the market, not because of action by gasoline producers, but primarily because the claims are found to be fraudulent.

Anyone can put a 14-h.p. motorcycle engine in a light car and get a 100 miles per gallon of gasoline. We feel sure that the gas companies would not mind it at all. Such economical cars are popular in Europe where gas is expensive. In this country the public demands speed and power. You can't have these with super economy—not yet, anyway.

Jet Propelled Airplane

Boyd Peterson of Gilmanton, Wisconsin, asks us not to reveal his idea "because it is so simple." There is one important point you have overlooked; namely, your jet propulsion scheme must be made workable.

ANSWER: *We never disclose details of ideas we consider worthy of further development. But, how do you intend to mix the gases for the explosion? How are they going to be compressed? How will they be exploded for the greatest efficiency? And how are they going to be released?*

All that you seem to be doing now is to outline a very rough sketch of the working principle of the common and rather popular supercharger. This, as you know, already is in use. You have added nothing to the present design.

Keyway Screw Driver—Face Gasket

Joseph G. Bosley, Seattle, Washington, asks about a new style of gasket, a keyway style of screw driver, and a motor-driven hacksaw.

ANSWER: *We do not hold as high an opinion of the new style of gasket for high pressure steamline as is envisaged by you. We do not agree that the gasket with annular grooves would flow better.*

In any face gasket it is the square inches of surface area which counts. By your construction you would be decreasing this surface area. Sup-

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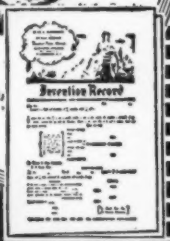
INVENTORS

TO PROTECT THEIR INVENTIONS

How To PROTECT, FINANCE and SELL YOUR INVENTION



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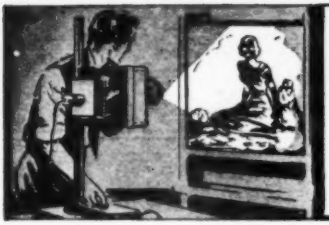

Chips from the EDITOR'S WORKBENCH

Now—Color At Home

At last the long awaited announcement has come! Amateur photogs can sweep out their darkrooms, move over some of the black and white equipment and make room for the color processing stuff!

Ansco Corporation's new color film has been released for sale to the general public, after being the exclusive property of the Army and Navy since shortly after the start of the war. The film can be processed at home in only 90 minutes, with but 15 minutes of that time in the darkroom. With the aid of a few simple chemicals and several easy developing steps, the amateur shutter bug can now produce color transparencies equal to or better than those formerly processed professionally. Ansco color film will be available in all standard cut film sizes, and in 16 mm. movie film. An inexpensive developing kit for the color film will also be obtainable.

ELECTRIC JEEP

Here's a midget Jeep which is the envy of all the kids in the neighborhood! Mr. Frank Fox of Omaha, Nebraska, made it for his son from wood; power is supplied by a six-volt Le Jay motor which will run five hours on one battery charge. It has real lights, a horn and a hand brake. A $5.00 Workbench award and a Certificate of Merit to Mr. Fox for a fine job.

Photo Contest

While we're on the subject of photography, we'd like to call your attention to the monthly Photo Contest for amateurs, which you will find on page 122 of this issue. Cash prizes are awarded for the four best prints received from amateurs each month, and if you are numbered among America's millions of camera fans you'll want to get in on it. Dig out your favorite picture *now* and send it in—it may win you some money as well as give you the kick of seeing your own work published. Read the rules on page 122, then get busy!

Current Events

A while back we were holding forth on the apparent lack of interest in substantiating or refuting Prof. Felix Ehrenhaft's magnetic-current theory with systematic experiments. It seems that since we penned our complaint the good Professor has had pretty much the same idea, and did something about it. Result: another Ehrenhaft eye-opener, the first magnetic motor the world's ever seen.

This refugee-scientist has a flair for demonstrating the spectacular on the rudimentary level of the home workshop. Certainly, anybody with a mechanical bent could rig up the apparatus with which Ehrenhaft has shown, to the satisfaction of many top-flight physicists, that magnetism flows. His latest contraption is really a honey for the tinkerers. All you need, to build a motor operating purely on magnetic current, is a permanent Alnico magnet, a solution of ferric chloride, and a microscope through which you can watch the rotations caused by magnetic influence. What you'll get won't produce power that you can harness for practical tasks, but according to strict definition it's an honest-to-God motor, all right.

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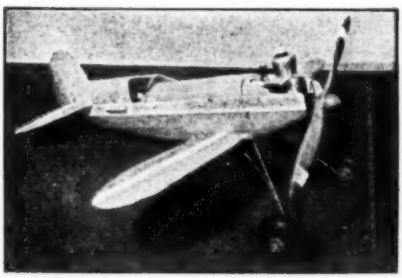
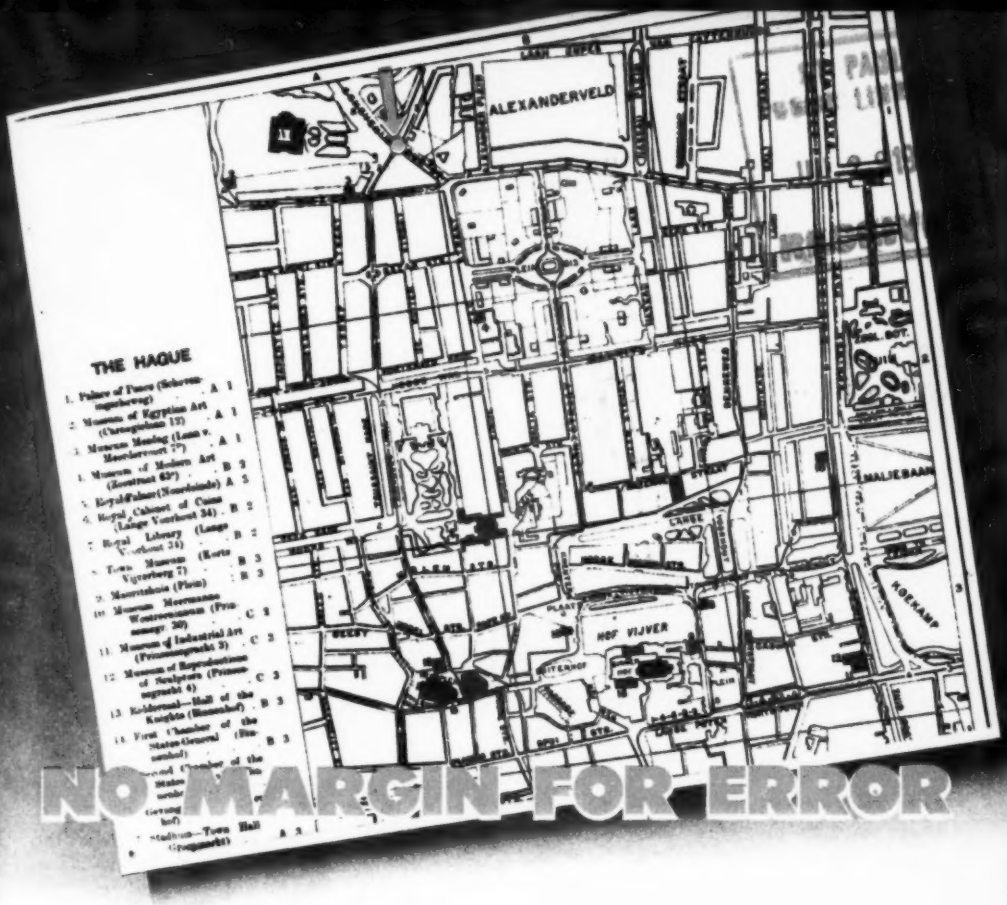
DEFINITELY FAST



Willmar Leske, Aberdeen, S. D., turned out this sleek little control-line gas model. The span is 24 inches, and Mr. Leske tells us that it's definitely fast. It looks it, and it nets a $3.00 Workbench award and a Certificate of Merit.



by Richard Hanser

This was the most ticklish bombing mission of the war—to destroy one house on a certain corner of The Hague.

LONDON—If you saw it at the movies you probably wouldn't believe it. The scenario would go something like this:

A dignified, white-haired Major-General (probably played by Lewis Stone) summons his most dashing young pilot (probably played by George Montgomery). After the usual exchange of salutes, the Major-General gravely says:

"Lieutenant, I have a mission of the utmost importance for you. There has been nothing quite like it in this war. Through secret underground sources we have come into possession of information which tells us that a certain house in a certain city on the Continent contains documents of the greatest importance to the enemy.

"I want you to single out that particular house and bomb it to bits in broad daylight without touching any of the surrounding houses. You must do it on the first attempt. There will be no second chance. Much depends on the success of this mission. Do you think you can bring it off?"

Whereupon the dashing lieutenant snaps to attention, says "Yes, sir!" in clear, crisp tones and, turning smartly on his heel, goes out and blows up the house. . . .

This picture, taken from one of the bombers on the raid, shows the perfect hit scored on that vital Gestapo building in Holland.

That's the way Hollywood, in one of its more implausible moments, would do it; and that, as a matter of fact, is practically the way the RAF *did* do it in what the British Air Ministry has described as "probably the most brilliant feat of low-level bombing of the war."

Of course, the real life version of this adventure had certain elements that Warner Brothers or Metro-Goldwyn-Mayer would be likely to overlook in favor of working in some sex appeal in the shape of Veronica Lake. There was no sex appeal in the real life version, but it had everything else.

It had, to begin with, Wing Commander Richard Norman Bateson, a 32-year-old flying bearcat from the green hills of Sussex who had won a D.F.C. for brilliant leadership in the North Africa campaign and who was also awarded the D.S.O. for carrying out a secret operation, presumbably the house-wrecking job referred to above. Commander Bateson led the formation of six Mosquitoes which carried pin-point precision to the point of dropping bombs on the very doorstep of the designated target.

It was in April that the Second Tactical Air Force of the RAF was asked if it would be possible to destroy a single house in a given city without damaging the buildings on either side. The Air Force commanders agreed to do it with Mosquitoes on twelve hours' notice.

The reason that the venture was regarded as one of supreme importance was that secret underground information—which, in this war, is much more than a romantic ingredient of movie and magazine plots—had revealed that the house selected for destruction contained "many thousands of documents of paramount importance to the enemy." This was probably the first time in the history of air war that the objective consisted not of war plants and military installations but of pieces of paper.

The first scene of our scenario was written by the Dutch "ondderduiker"—underdivers. or underground workers. In the Netherlands almost everybody from 18 to 30 has good reason to evade the Germans, because of labor conscription. Of 12,000 university students. no less than 6,000 are in hiding. Only 4,500 have been deported to Germany.

Feeding such a huge illegal group presents a problem. To solve it, the underdivers constantly raid German officers to steal their ration books and identity cards. Finally, just this year, the Germans decided to call in all papers and issue new ones, in order to catch the underdivers. It was at this point that the

And this reconnaissance photo, taken the day after the raid, shows nothing except the target and army barracks were touched.

Dutch appealed to the RAF for help. In the former art gallery opposite the Peace Palace in The Hague was housed the card index of the labor service. If that index was not destroyed, the Dutch underground was doomed.

The briefing of the six Mosquito crews was conducted with complete secrecy. The number of officers who usually attend such sessions was cut to the barest minimum. The officer in charge stood before a map with a pointer.

The pointer moved across the map until it came to Holland. It moved across Holland until it came to The Hague, a city of 500,000 people. It moved through the maze of streets in The Hague until it came to a single thoroughfare, the Scheveningsche Weg. It moved along this street until it came to rest on a tiny area representing a single house.

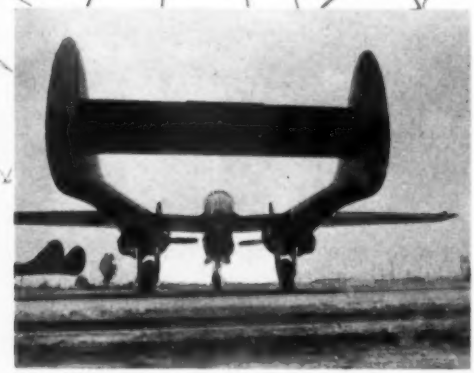
"Gentlemen," said the briefing officer. "That is your target."

A scale model was built and intently studied by the Mosquito crews. They noted that their target-house was on the Scheveningsche Weg near its junction with the Carnegie Plein, in which the celebrated Peace Palace still stands in ironic splendor.

In addition to absolute precision, which was to be the guts of the whole undertaking, there were a number of other factors involved which prompted experts to describe the operation as "the trickiest of the war." It would be necessary to carry out the attack in such a way that in case it failed, the Germans would be left in the dark as to its purpose. The planes must maneuver and approach the target with the object of [*Continued on page* 145]

Hero of the amazing mission, Wing Commander Robert Bateson, who flew the lead position in the Mosquito formation. He got the D.S.O. for his brilliant job.

BLACK WIDOW

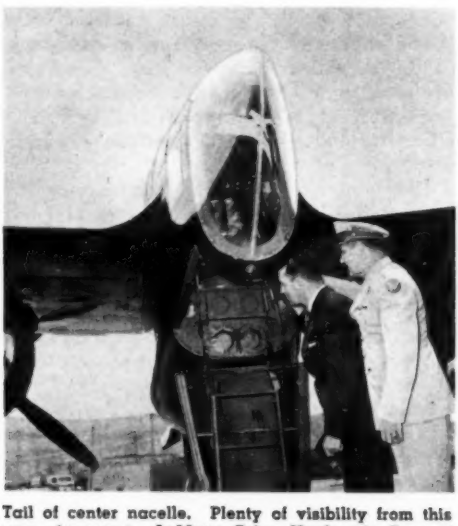


Rear view of new Army Air Force Black Widow night fighter. Four-bladed Curtiss propellers and tricycle landing gear are among plane's distinctive features.

Going up! From below long center nacelle distinguishes the Black Widow from the Lightning. Liquid-cooled engines of Lightning and slender noses compared to relatively blunt noses of Black Widow also aid in telling the two sky fighters from each other.

THE Northrop P-61 "Black Widow" is the first warplane designed from the ground up as a night fighter. Weighing more than eight tons, the ship is powered by 2,000 h.p. Pratt & Whitney engines. Its armament includes a battery of 20 mm. cannon and .50 calibre machine guns.

In appearance the "Black Widow" somewhat resembles the Lockheed Lightning, but all details as to speed, range and maneuverability are still secret. Two or three men comprise the ship's crew.



Tail of center nacelle. Plenty of visibility from this rear view spot. LaMotte Cohu, Northrop's General Manager, is showing the new ship to General Stace, AAF. Most details of this new ruler of the night skies and its performance are still a closely guarded secret.

OPEN SESAME

by Lawrence Lader

Barney demonstrating his most spectacular invention, the Lockaid Gun, which will jimmy any lock ever made.

Barney Zion, wizard of the locks, was stumped only once—when he tried to invent a lock that he couldn't pick.

WHEN Government men moved in quickly and silently on one of the largest hotels in midtown Manhattan a few months back, they had all the strings of their net ready to pull tight on one of the cleverest enemy spy rings in the United States. Upstairs, in one of the rooms, they knew that the evidence they needed was packed in five trunks and four suitcases—all of foreign make. They had planned this moment for weeks, and it was ready, except that they had only twenty minutes while the room was empty to open and close the locks of each trunk and suitcase. The stage was set, the curtain was up, but the star was missing. "Get Barney Zion," the police barked.

While G-men stood guard in the lobby of the hotel, in the corridors, and outside the door, a mild, gray-haired man with the eyes of a professor was rushed into the room. Nonchalantly, as if he were opening a child's piggy bank, he began to work on each lock. Finally, one of the G-men whispered: "Only five minutes left, Barney!" The gray-haired man opened the last lock, wiped his hands on his handkerchief, and then went back to work—making a set of keys for each trunk and suitcase. "We got to get out of here," the G-men begged. "Just a little gift for you," Zion laughed. "I'm making keys so you can open the bags yourselves next time." And he finished them—with sixty seconds to spare.

Barney Zion, who is probably the outstanding lock man in the United States and the only man in the world who can make a key for any lock, spends much of his spare time answering SOS's from the police. Whenever they are faced with an unsolvable problem of locks, the cry almost automatically is: "Get Zion." Sometimes he has to rescue a jeweler who has locked his keys in the safe, sometimes extricate a merchant who has locked himself in his store. And, just as often, it's the police who need help.

A few years ago when the safe of Salant

Just for the fun of it, Barney built this unique machine in his spare time. Sing Sing residents please note: it will make duplicate jail keys!

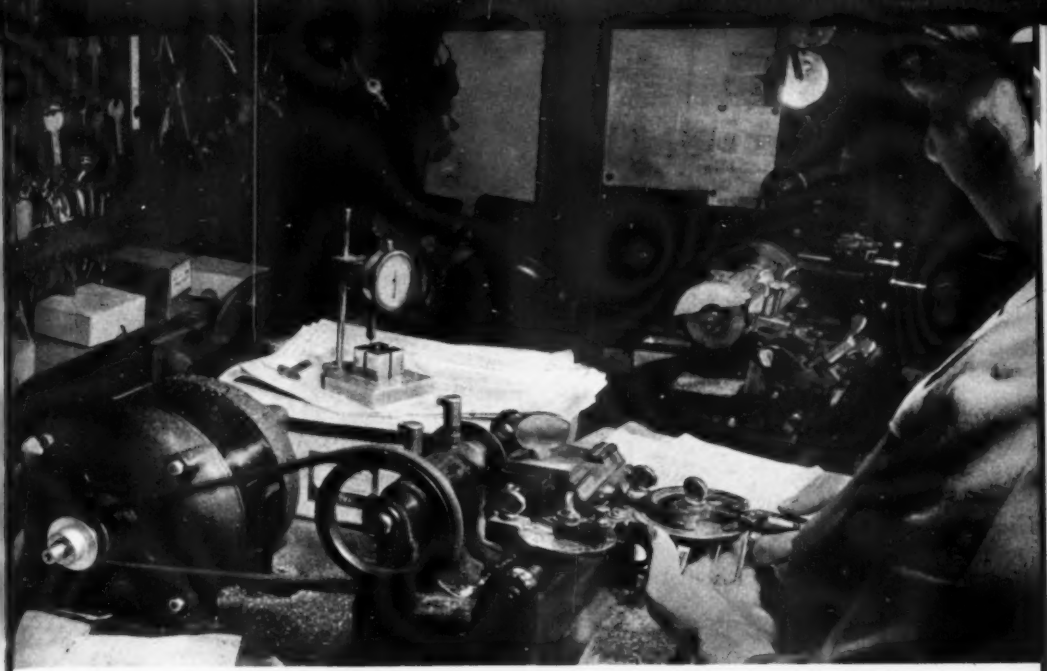
and Salant, Inc., Manhattan shirtmakers, was rifled, the police examined every inch of the lock and hinges and couldn't find a clue. It looked like an inside job till the order came: "Get Zion." One glance, and he made a discovery that had been completely overlooked—a tiny hole 20/1000 of an inch in diameter above the tumblers. The robbers had inserted a needle and held up the tumblers of the lock while they worked at them through the keyway. Linking up this method of safe-cracking with four or five others, the police identified the robbers and took care of the rest—at Sing Sing.

Although Barney Zion is officially President of the Majestic Lock Company, next door to the Woolworth Building in downtown New York, unofficially he is consultant, teacher, confidant, and grand wizard of all knowledge on locks and keys to the nation's police, G-men, the Army and Navy, and Intelligence men of every branch of the government. Since Pearl Harbor, they have been flocking to his straggling four-room office off lower Broadway as the Greeks flocked to the Oracle of Delphi. They drop in any time of the day or night and stay for an hour or a week. Even the head of the government's lock school in Washington, which most Intelligence men attend, is one of Zion's students. He often comes up to New York over the week-end to get the answer to unanswerable questions that his classes toss at him. Zion becomes fast friends with all his pupils, and if they are going overseas, makes it a tradition to blow them to the best dinner in town and a round of the night clubs.

Although not actually employed by the government, Zion always stops his own work to teach some new trick to any Army or Navy Intelligence man who drops into his office—tricks which may mean the difference between the success and failure of their missions. Many of them work underground in enemy territory. They must go into a country "clean"—without a single tool on them. Zion shows them how to make their own tools and even open locks without them. Recently an Army sergeant struggled for ten minutes with a large padlock. Finally Zion stopped him. "Watch this," he said. Grabbing a hammer and holding the lock in the palm of his left hand, he gave one quick blow to the band, just over the catch. The lock snapped open. "Of course, I don't say that'll happen every time—but it usually does if you hit it right," Zion explained. "You see, this type of lock is held by a spring in there. One sharp blow on the side usually loosens it." The sergeant tried again and this time it worked. "Well," Zion laughed, "I'd better be careful how many tricks I teach you."

Completed orders are handed out over the counter by Mrs. Zion to a series of delivery men who come and go all day long. Sometimes they pay cash, but more frequently they say: "Charge it to J. P. Morgan," or "Charge it to General Electric." Regular customers include Sperry Gyroscope, Standard Oil of New Jersey, Pratt Whitney, Western Electric, The Aluminum Company of America, the Chase National Bank, the Empire Trust Company, the Navy Yard, the Columbia Broadcasting System, the National Maritime Commission, Empire State Building, and a long list of equally impressive institutions.

No less a personage than the Under-Secretary of War called up the Zion establishment once, probably in a moment of depression brought on by his many worries at home and abroad. He had four homes, to be exact, in and around New York, and he had conceived the brilliant if over-simplified solution to one of his many problems. All the locks in his houses were to be fitted to one master key. Barney Zion of course knocked

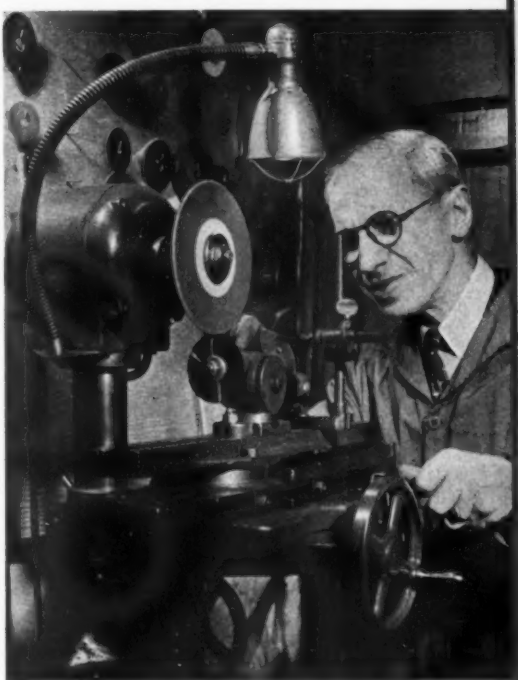


Mrs. Zion cuts keys by code on another special machine which uses code plates made by Barney. Alongside are plates, key blanks, finished keys. If key doesn't work, it's the lock that's no good, not the key!

this idea into a cocked hat. "I told him he could have done it if they were all Yale locks, or something like that, but he had all kinds of locks in there, with garages and everything. I told the Under-Secretary to give up the whole idea, it was out of the question."

Barney has on several occasions been forced to take important people down a peg. Perhaps his favorite story of this sort involves a local Board of Education. "It was around election time one year," he says, "and I think they were afraid somebody would go in and steal their records or something. Anyway, they called up the Yale lock people to see if they could have one of their locks fixed up so that only one key and no other would open it." As generally happens in such cases, the Yale people referred the Board of Education to Barney Zion.

Barney found the chairman a pompous and stuffy individual, who in the course of their discussion challenged Barney's matter-of-fact attitude toward lock-picking with a remark about the stupidity of anyone who believed hairpins could do the trick. To which Mr. Zion answered coolly that it could be done, if one had a hairpin. The Board man, taken aback, began to corral all the office girls, but as styles would have it, not a hairpin was to be found. Barney put on his hat and coat, saying he'd try some [*Continued on page* 140]



Barney dresses down a worn cutting wheel and cuts new teeth in it with a machine of his own design. His wheels turn out sharper than brand new ones.

20TH AIR FORCE

AMERICA'S Air Power enters a fantastic new phase with the creation of the Army's 20th Air Force, comprising fleets of long-range Boeing B-29 Superfortresses. The B-29 boasts a wing span of 141.2 feet, length of 98 feet, height of 27 feet. No less than 150 small motors ride the aerial giant. Four Wright Cyclone engines (over 2,000 h.p. each) provide a speed above 300 m.p.h. Armament includes power turrets, 20 mm. cannon, computing gun sights, an undisclosed number of .50 cal. machine guns. Soundproof, pressurized cabins permit altitudes possibly above 40,000 feet. The Superfort carries more bombs than any other plane, has greatest tactical range.

Here Are the Winners!

TOP CONTESTANTS IN THE GREAT MI "BUILDWORDS" GAME

THE Fourth M.I. Buildwords Contest is now history. More than 20,000 readers submitted entries. R. Davis, First Prize-Winner, uses many unusual words, but none that were not used by other contestants. Mr. Davis' success resulted from using more high-numeral acceptable words than anyone else.

There were number of entries with higher scores than Mr. Davis' 1232, but they were disqualified for several different reasons. Some contestants added their letter values incorrectly; some counted word values instead of letter values, with the result that they counted some letters twice; and a large number of contestants used unacceptable words. Their difficulty arose from a misunderstanding of Contest Rule No. 5, which read in part, "Words appearing anywhere in this dictionary, as well as forms of those words in accepted usage as constructed under dictionary rules, will be permissible." They took this to mean that they could use abbreviations, Roman numerals, chemical symbols, and other substitutes for words. In various places Webster's points out that word substitutes are not words.

Nor did Rule No. 5 permit the coining of new words. Prefixes and suffixes may not be added on to existing words; only usage can make new words in that way, and all such new words are recorded in the dictionary. The forms of words meant in Rule No. 5 were inflected forms of verbs now in use, regularly formed plurals (including plurals without regard to meaning, but to only one degree), and the comparative and superlative degrees of adjectives. Inflected forms of verbs found in the footnotes were not permitted because they cannot be considered to be in accepted usage. For these reasons, made words like "depep," "pleened," "lynchy," "peepled," "peeplet," etc. were disqualified. "Depeopled" is the inflected form of a verb in accepted usage; "depeepled" is not.

Win or lose, the Editors hope that all contestants enjoyed working on the Contest. A good many contestants wrote to say just that, and to add that they were looking forward to next year's Contest, when they intended to try again.

Below is reproduced Mr. Davis' entry, together with page references to Webster's new International Dictionary, 2nd Edition.

[*Continued on page* 155]

1. R. Davis, 8154 San Gabrial Avenue, South Gate, California—$1,500 in War Bonds.
2. Mrs. W. H. Hays, General Delivery, Clyde, Kansas —$1,000 in War Bonds.
3. Miner Gamble, 947 Marshall Blvd., San Bernardino, —$750 in War Bonds.
4. Mrs. Nina Hansen, 208 E. Avenue 33, Los Angeles 31, Calif.—$500 in War Bonds.
5. Mrs. W. W. Haggard, Beverly, Kansas—$250 in War Bonds.
6. W. C. W. Renshaw, 301 N. Kanawha Street, Beckley, W. Va.—$175 in War Bonds.
7. S. E. Arnold, 11 S. High Street, Mechanicsburg, Pa. —$125 in War Bonds.
8. Frank C. Bradley, Vets. Administration, Los Angeles 25, Calif.—$100 in War Bonds.
9. Miss Jenny Johnson, 3709 Milwaukee Street, Denver 5, Colorado—$75 in War Bonds.
10. Carter & Blair Renshaw, State Teachers College, Farmville, Va.—$50 in War Bonds.
11. John W. Allen, 815 Orange Grove Ave., South Pasadena, Calif.—$25 in War Bonds.
12. Madeline McDougall, Scott's Lake Road, Salem, N. Y.—$25 in War Bonds.
13. Elbert Swafford, R.R. 2, Cobden, Illinois—$25 in War Bonds.
14. Ethel M. Shroy, 345 Carlisle Street, Gettysburg, Pa. —$25 in War Bonds.
15. Mrs. Paul H. Johnson, 552 So. Sixth Avenue, Clinton, Iowa—$25 in War Bonds.
16. Lora Butler, 1630 Jones Street, San Francisco—$25 in War Bonds.
17. Mrs. Addie L. Cornwall, 1607 Encino Ave., Monrovia, Calif.—$25 in War Bonds.
18. E. C. Konopka, 1139 Norwood Avenue, Toledo, Ohio—$25 in War Bonds.
19. Ben F. Shaver, 1116 So. Barrington Avenue, Los Angeles 24, Calif.—$25 in War Bonds.
20. Joe Verderber, 810 So. Flower St., Los Angeles 14, Calif.—$25 in War Bonds.
21. C. W. Tulleys, 429 N. Kenwood Street, Glendale 6, Calif.—$25 in War Bonds.
22. Della Marrs, 17031 Dalton Avenue, Gardena, Calif. $25 in War Bonds.
23. Mrs. M. Trojan, 3569 E. 133, Cleveland, Ohio— $25 in War Bonds.
24. Mary K. Wolak, 11 Allison Street, Middletown, Conn.—$25 in War Bonds.
25. Gerard J. Pelletier, 605 St. Maurice Avenue, New Orleans 17, La.—$25 in War Bonds.

[*Continued on page* 157]

CYCLES PREDICT THE FUTURE

by Donald G. Cooley

Author of "Your World Tomorrow" (Duell, Sloan & Pierce)

Will your job hold out? Should you buy that house? Cycles tell what's ahead in business.

WHAT'S ahead for your job—will men be laid off in your line of work, and if so, when? Will you be farther ahead if you continue to pay rent, or is this a good time to buy a house? Aside from patriotic motives, is it good business to put your surplus funds into War Bonds, or smarter to buy tangible properties in the hope that their values will increase? Farmers hope food prices go up, consumers that they go down—which is it likely to be?

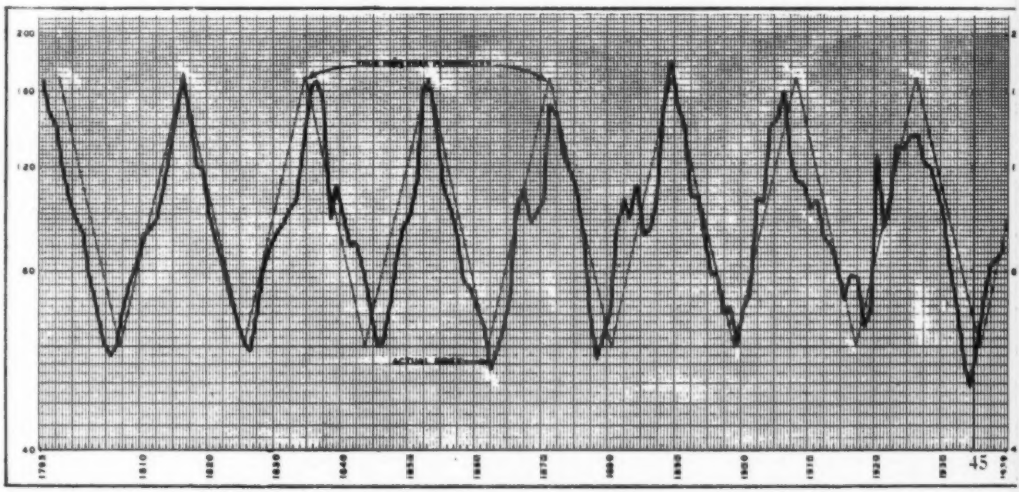
Call these problems "economic" and they sound dry and technical. But they come alive in a hurry when you realize that they include everything you spend money for and all your reasons for wanting money at all. A lot of your dreams are wrapped up in economics. Even love carries a price tag, for marriage makes the money go.

Business cycles are therefore of the greatest personal importance to you. The essence of a cycle is that it repeats itself. Many cycles not only repeat themselves but do so at regular intervals of time. For instance, the minor business cycle averages 41 months in length, the major cycle, just short of nine years. Scientists are uncovering increasing evidence that these rhythms are not accidental. Powerful, unknown cyclic forces seem constantly at work. The study of cycles, therefore, gives us a remarkable new scientific means of forecasting future events—not a substitute for judgment or intelligence, but a rather amazing supplement to them.

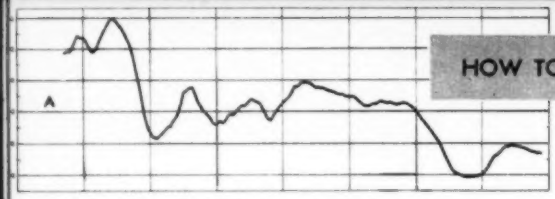
Your job and your income are intimately affected by booms and depressions. Cycle forecasts indicate a business setback later this year, a boom for 1945, and a depression around 1947 (MECHANIX ILLUSTRATED, June, 1944). This is a general, long-term forecast, but specific enough to be put to very practical use.

It is indicated that the job situation will not become shaky until after 1945. By 1947 depression and fairly widespread unemployment may be upon us. How will *your* job stack up in tough times? Would you be easy to replace, hence easy to lay off? Is yours a dead end or a war boom job?

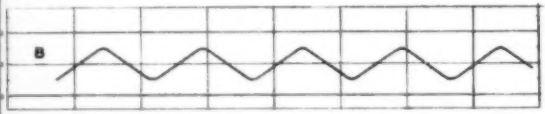
An index of major building activity in the United States, 1795-1937, after adjustment for trend. An 18.3-year periodicity has been added. Note that wars—1812, Civil, 1898, 1917—had little if any effect on the cycle trend. Cycles predict a downward trend in building, lasting to 1952.



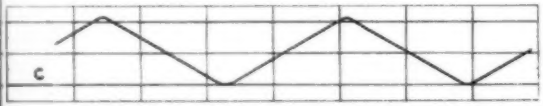
HOW TO PROJECT A BUSINESS CYCLE



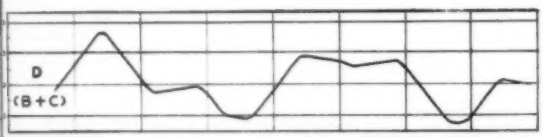
(A) To work out complex cycles in its business, a public utility company charted its sales variations, 1903-1939.



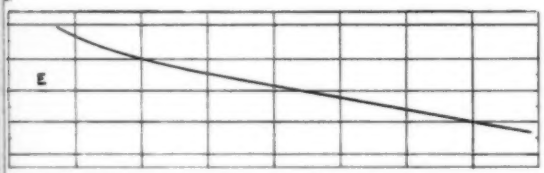
(B) One rhythm in this company's business has a 7.5-year wavelength. Above chart shows a 7.5-year periodicity.



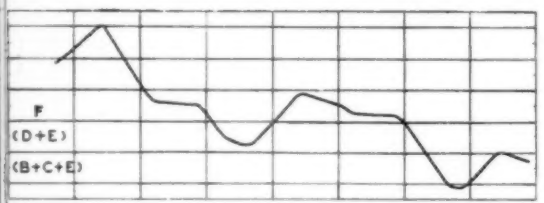
(C) But company's business also has longer cycle of 18.3 years. An 18.3-periodicity is shown in the chart above.



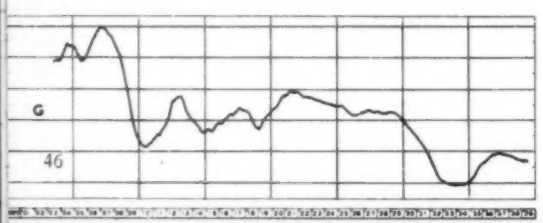
(D) If 7.5-year and 18.3-year cycles are synthesized, interaction of two rhythms produces pattern pictured above.



(E) Throughout, company's business has shown a general tendency to increase or decrease. Here's the trend line.



(F) Now we have general trend line, plus 7.5-year and 18.3-year rhythms, all synthesized into a single line.



(G) Chart A again (actual record of business). Note how close mathematical synthesis (F) came.

A look ahead indicates that now is the time to train for higher skills, to take courses that make you more valuable, to get into appealing fields of work which may be closed to newcomers if depression hits. The man who waits until depression strikes to advance his training is usually too late. If the depression cycle follows its anticipated course, you have some three years in which to become indispensable.

A still longer view into the future is encouraged by the notable cycle studies of Dr. Raymond H. Wheeler of the University of Kansas. He and his staff have collected many thousands of items, charted them carefully, and produced astonishing evidence of ups and downs in human affairs which have repeated themselves in amazingly regular waves through the past 1,500 years. Dr. Wheeler's cycle charts indicate that, probably during the 1950's, we shall come into a highly disturbing era of strikes and labor unrest, and that businessmen may anticipate a relaxing of government restrictions but an increasing amount of vicious, cut-throat competition. There is a vocational hint in the probability that international trade will be vastly more important.

Many people making good money are now acting as if good times will last forever. That's human. But cycles warn us clearly that good times are followed by bad, and that no intervention of man or government has ever succeeded in flattening cycles into a flat plane of prosperity.

It is therefore sheer, hard-headed business sense to put surplus funds into War Bonds. In time of war prepare for peace, and a probable depression. If the latter arrives on time around 1947, your savings will be liquid and will tide you over hard times, or enable you to snap up bargains at low prices common in eras of distress. In depressions the purchasing power of money usually goes up, while properties bought in boom times at fancy prices tend to decline.

The date for V-Day—the total end of

the war—can be predicted by the bold-spirited on a basis of cycles. Let us not involve eminent cycle scientists in this daring venture, but merely stick our own necks out. Depressions characteristically do not occur during wartime, but some little time after the wars are over. World War I ended within two months of 1919, but the depression did not hit until 1920. If a depression hits in 1947, as the cycles indicate (it has been forecast as a major post-war depression) presumably the war will have been over for at least a year. Crawling out on a very long limb, then, we name the year of the war's complete end as 1946.

We are on more solid ground when we consider the importance of building cycles to your future. You have to live somewhere. You either pay rent for a house or apartment or hotel room, or own your home. The structure you live in may have been erected at a period of high or low costs. It makes a difference to you. Business structures are also affected. Yet among the most regular, and therefore the most predictable, of all cycles is that affecting building construction.

Since 1830 the country has had six marked building cycles and we are now somewhere in the middle of the seventh. Prof. Alvin H. Hansen and other economists have charted these cycles and found that they have a remarkably uniform length of approximately 18 years. Roy Wenzlick has carried these building cycles back to 1795.

The last complete building cycle ran from 1918 through 1934, in this rhythm: 1918, Low; 1925, High; 1934, Low. Adding the 18-year cycle to the last peak, 1925, we get 1943, and surmise that we have just passed the peak of the current cycle. We should now be at or near the beginning of a downward trend in building which should continue until 1952 (the last Low, 1934, plus 18 years).

If the rhythm runs true to form, what does it mean to you? The indication is that building values are now at their maximum, or a little past it. If you have property to sell you should now get a better price than for years to come. On the other hand, if you buy you should expect to pay more than you would have to in later years. Of course it must be remembered that we are speaking of averages, and that individual bargains are always possible at any phase of the cycle.

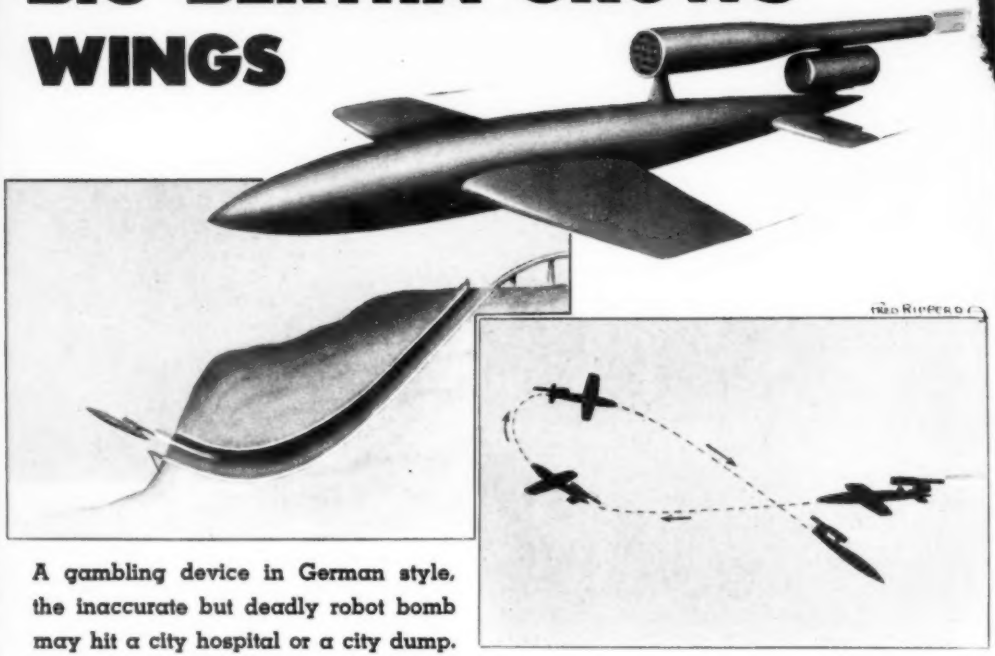
Generally, building is more profitable on the up than the down side of the curve. On the upswing, values are increasing; you are more likely to be able to sell the completed structure for more than it cost. It would be least profitable to build at the peak, but another cycle top is not expected for 18 years.

It is possible that the present peak may be flattened by the war, to accommodate a certain amount of postwar building activity. Remarkably enough, however, the building cycle has been almost unaffected by past wars.

Whatever the trend of the cycle when hostilities struck, it continued [*Continued on page* 147]

CYCLES PREDICT:

BIG BERTHA GROWS WINGS



A gambling device in German style, the inaccurate but deadly robot bomb may hit a city hospital or a city dump.

IN 1918 the Germans shelled Paris from a distance of 76 miles, using a long range gun named the "Big Bertha" after the Krupp company's boss, Frau Bertha von Bohlen. Today the descendant of the Big Bertha is a winged bomb, propelled by a rocket-like tail jet. In its commonest form the robot is slightly over 25 feet in length and about 16 feet in span, carrying approximately a ton of explosives or the equivalent in fire bombs. Its speed is from 300 to 350 and its range about 150 miles, according to available information. A large flying robot bomb, 40 feet in length, with a speed of better than 600 has also been reported sighted off the English coast.

The robots are launched from steep ramps not unlike roller coasters. Intensive bombing of these structures has hampered their wider use above ground. Underground launching ramps may exist in European coastal cliffs.

The extreme inaccuracy of the robot bomb makes it useless as an effective weapon against purely military objectives but does not prevent it from being a deadly random killer. With only gyroscopic control to guide it, the robot may strike anywhere within thirty miles of its intended objective.

When their power is exhausted the robot bombs plunge to earth at about a 30° angle, usually turning back upon their course or circling as they dive, so that their point of impact cannot be easily predicted.

Counter measures that have proved effective against the flying bombs include ack-ack and direct attack by pursuit planes. The robots fly in a straight line at 1,000 to 2,000 foot altitudes, and cannot defend themselves against fighter attack.

Constructed largely of metal, the robots have so heavy a wing loading that speeds of 300 or better are a virtual necessity in order to maintain altitude. Settings for altitude and drift must be made before launching.

The relatively slow speed of the robots in comparison to that of an artillery shell makes them subject to every wind change. The Big Bertha shell of 1918, while only 246 pounds in weight, traveled at nearly ten times the speed of the robot bomb, and showed far greater accuracy. Once the Big Bertha shell was fired there was little defense against it, as it could not be shot down as can the robot bombs of today. It is interesting to note that the tentative tactical defense against the robot bomb had been worked out long before the Germans first used them.

MIRACLES TO COME

"ONE BRAND NEW LIVER, SIZE X-39!"

This slightly worn gentleman, who probably could use a new liver, may be able to buy one when our scientists manage to produce custom-made organs.

Our top-flight scientists, and their forward-looking students, draw some startling pictures of wonders ahead.

by Morgan Deming

WHAT'S cooking for tomorrow in the world of science?

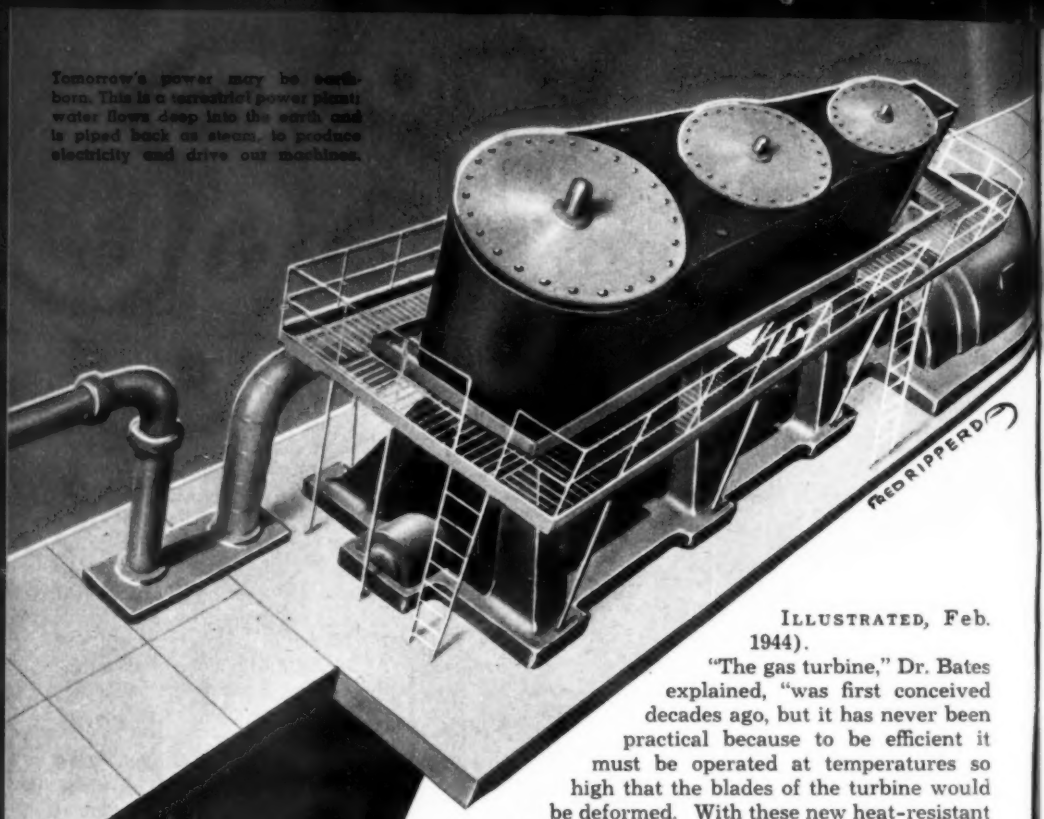
Some very startling dishes, if we are to judge from the scientists and scientists-to-be who are concocting them. Our new crop of scientists, represented by young people from the nation's high schools who won Westinghouse Science Scholarships in the annual Science Talent Search, recently heard leaders in various fields discuss unfinished projects which promise to change the world. And the young prize-winners expressed some very definite ideas to which they propose to devote their lives.

Take tomorrow's airplanes. They may be shaped like V's, or blunted arrowheads, or fat tears, may have propellers in the tails or no propellers at all, be driven by new kinds of power plants and built of metal alloys not yet in existence. Enormous changes, radically new ideas, await scientific development.

"Wind tunnel tests and theory indicate that airplane drag can be reduced almost another 50%," Dr. R. G. Robinson of the National Advisory Committee for Aeronautics told the Science Talent winners. "Present-day power plants still convert only about one-third of the energy in fuel into useful power. The remainder is wasted in the engine exhaust, in the cooling air, and through other means of escape."

It is worth $30 a pound to devise new aircraft shapes which will reduce drag to the theoretical limit. This is what it costs—per year!—to haul around a single unnecessary pound in a commercial airliner.

The gasoline motor as we know it may well be on the way out as an airplane power plant. New metal alloys forecast revolutionary developments. Dr. A. Allan Bates, head of the metallurgy department at Westinghouse, told the young scientists of an alloy which will not melt or become deformed at temperatures which would make ordinary steels flow like warm butter. Similar alloys may make the gas turbine—a sort of enclosed windmill driven by a continuous hot blast of gases—of startling importance (MECHANIX



Tomorrow's power may be earth-born. This is a terrestrial power plant; water flows deep into the earth and is piped back as steam, to produce electricity and drive our machines.

ILLUSTRATED, Feb. 1944).

"The gas turbine," Dr. Bates explained, "was first conceived decades ago, but it has never been practical because to be efficient it must be operated at temperatures so high that the blades of the turbine would be deformed. With these new heat-resistant alloys, a practical gas turbine may be built. Eventually, the gas turbine, combined with electric generators and motors, may replace the internal combustion engine as the accepted power plant for large airplanes."

As a primary source of energy, the richest rewards of all lie in what physicists call "the mechanics of the nucleus"—the unknown forces which hold the atom together.

"Electrical energy tending to blow up any atomic nucleus is some 10,000 times greater than the usual chemical energies such as the fuel value of coal," said Dr. E. U. Condon, noted physicist. "Nevertheless most atoms are quite stable so there must be strongly attractive forces of a new kind, operating between the particles of the nucleus, which hold it together in spite of the explosive tendencies of the electrical forces. These new forces are presumably non-electrical in character, for they act between proton and neutron (the latter electrically neutral) in much the same way as between proton and proton."

Technical talk—but of what titanic significance! Imagine an automobile driven by a gallon of fuel which yields 10,000 gallons worth of power! A small sealed tank would drive the car for its entire lifetime. Or a cabinet in the home basement, much smaller than a furnace, would light and heat a house for a generation. We are a long way from such uses of atomic energy, but it is revealing that sober-minded scientists no longer scoff at such possibilities as wild-eyed dreams.

The great spectrum of radiant energy, which gives us visible light, radio, infra-red heat and ultra-violet suntan, we have barely begun to tap. Dr. S. G. Hibben.

Westinghouse lamp expert, led the young scientists into this invisible world of promise:

"In tomorrow's civilization, perhaps the greatest promise of better days lies in the great rainbow of the ether spectrum, or the radiations encompassed between long wave radio broadcasting all the long way up to the secondary radiations associated with cosmic emanations where frequencies are measured in millions of millions of millions of cycles. We have not developed all of the tools that some day may be put to use in all of the 80 or more octaves of this great ether spectrum, and since there are still 'darkest Africas' to be explored, therein lies an exciting challenge to coming generations of scientists."

Some of the unknowns which Dr. Hibben believes cry aloud for development are: "How to get two colors from the same electrical discharge in a gas or vapor; how to conserve fuel by placing radiant heat directly upon the body rather than to heat the air; how to develop indoor sunshine for a vegetable garden in the basement; how to develop walls and ceilings as softly glowing light sources."

Translate these into full development and you have a few tiny lamps in the home which, focusing invisible beams upon your body, keep you warm as toast in an icy room. You have a year-round crop of fresh vegetables constantly maturing in the basement. You have a kitchen range which, instead of gas burners, uses flat shallow heat lamps which fry eggs with light.

A good idea of the things we may expect tomorrow comes from Science Talent winners themselves. They, and other young folk of their generation, are the ones who will have to make tomorrow come true.

Charles Davidson of Ft. Bridger, Wyoming, won the boy's $2,400 Westinghouse Grand Science scholarship. One project on which he is working is nothing less than a method enabling an army to travel in cars at night by invisible light, and to spy upon the enemy in darkness with super-cat's eyes!

"A searchlight could be played upon enemy lines and strong points while the enemy would be totally unaware of it," young Davidson wrote in his prize-winning essay. He dismisses as too slow and costly an older system, requiring an infra-red searchlight and pickup camera, the latter containing film to be developed to see what the light revealed.

"My system reveals the happenings immediately as they happen, and employs an electronic method of detection rather than film. I think it is quite possible to make a mobile unit of the device. This system employs either an ultra-violet or an infra-red light source and it would have to be a searchlight to concentrate the light. Since both ultra-violet and infra-red light are invisible to the eye we must use a system which is sensitive to it to pick up the reflected invisible light.

"It can be done by using an Iconoscope pickup camera such as is used in television. Since the Iconoscope is sensitive to infra-red and ultra-violet light [*Continued on page* 149]

If we master the mechanics of the atom's nucleus, you may be able to run your car for a lifetime on a gallon of incredibly powerful fuel.

WHAT CAN AIR POWER DO?

These death-laden Boston bombers, winging out over enemy territory in perfect formation, typify our mighty Air Power.

AN ENTIRELY new force and science has been born into this world in the past few months. Few have realized the existence of this titantic new power, much less understood it. Air Power at last is here—but not the Air Power envisioned by General Billy Mitchell or the Italian, Douhet, or Major Alexander de Seversky, nor even the Air Power forecast by more conservative writers on aviation in recent years. It is a type of force which has evolved from the test of battle. Its potentialities and its limitations are just becoming defined.

The birth of this new Air Power presents America with the greatest opportunity in her history. Britain seized upon the newly developed weapon of Sea Power in the 18th Century and built the greatest Empire in history with it. America, in the 20th Century, finds the new and much mightier weapon of Air Power literally thrust into her hands. With it, if she has the courage to do so, she can enforce peace upon the world.

Brigadier General E. P. Sorensen said recently, "Air power is now possibly little more advanced than was sea power at the time of the Phoenician raiders." General Sorensen's statement was published in the newspapers on the day it was publicly announced that a total of 97,000 tons of bombs had been dropped on Nazi Europe in one month's time—an average of approximately 2½ tons a minute for the whole month. The two statements, placed side by side, are of considerable significance.

What is this new weapon, Air Power?

Douhet, Mitchell, de Seversky and the other prophets painted a picture of it which has turned out to be mostly incorrect. The Walt Disney-de Seversky motion picture, "Victory Through Air Power," represents the popular conception of Air Power. According to this conception, great armadas of bombers appear over an enemy nation and simply bomb the nation out of existence.

The events of the past few months have proved beyond any doubt the error of such a conception of Air Power. At the time of this writing, for instance, Berlin had been raided

by
William Kimball

America is now the King of the Air. What does our new Air Power signify? What can it do? What are its limits?

132 times and a total of more than 45,000 tons of bombs had been dropped on it; Cologne had been raided 135 times, taking more than 12,000 tons; Essen, 61 times, with 16,000 tons; Hamburg, 112 times, with 14,000 tons. And yet Air Chief Marshal Sir Arthur Harris, writing in The New York Times, listed all of these targets as cities which "will still have to be dealt an occasional blow" if they are to be kept from producing.

There is no such thing as bombing a nation out of existence. It may even be said that there is no such thing as bombing a city out of existence, or even of destroying its value as a center of enemy resistance. The theory of the invincibility of naked Air Power died in the dust of Cassino. On March 15, according to Gen. Ira Eaker, a total of 3,500 tons of bombs was dropped on that small Italian village within a few hours, with the announced intention of "wiping it off the face of the map," and yet the Nazis held the Fifth Army stalemated at Cassino for months afterward.

Naval aviation learned a similarly bitter lesson in the limitations of Air Power at about the same time in the Pacific. As much as anything else, too great a reliance upon aerial bombardment was responsible for the high Marine casualties in the landing at Tarawa. The Navy learned its lesson in a hurry. At Kwajalein and Eniwetok, a few weeks later, it brought in its big naval guns for the preparatory bombardment and these islands fell with only slight casualties. Naval planes played a vastly important part in these battles, in a supporting role. But the Navy gave up any idea of "bombing an objective off the face of the map."

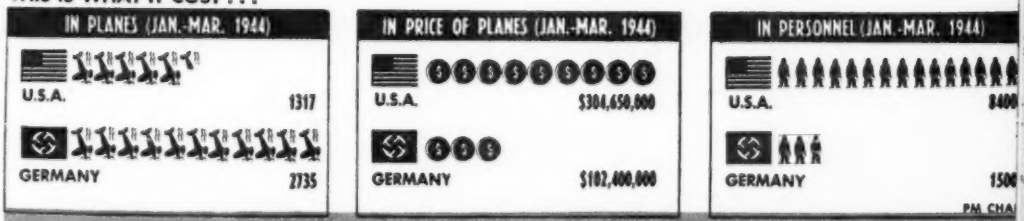
These and later experiences have spelled the end of the old-time conception of Air Power. All competent air observers are aware of this fact, although the public generally has not come to understand it.

In the place of the dead conception of Air Power, we now have a much more complicated picture of what this weapon is.

When the first "1,000-plane" bombing raids were staged over Germany in 1943, a great part of the public was lead to believe that the "air war" was finally at hand. Even so well informed a personage as a British air

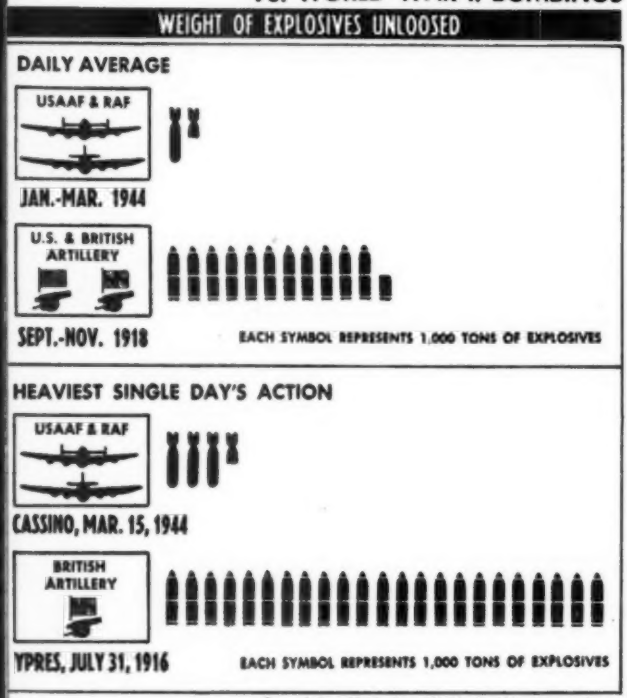
HAS OUR AIR WAR BEEN SUCCESSFUL?

THIS IS WHAT IT COST . . .



The magnitude of our aerial operations in the first quarter of 1944 was staggering, but it shouldn't lead to over-optimism. The price of the Air War is enormous too. True, we lost about half the number of planes that Germany did, but three-dimensional warfare cost us vast amounts of men and money.

WORLD WAR I ARTILLERY VS. WORLD WAR II BOMBINGS



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Our average daily bombing in 1944, in amount of explosives, is only a fraction of the daily load hurled by World War I artillery. We threw many more shells at Ypres than bombs at Cassino.

marshal was quoted as saying, "Let me put 20,000 bombers into the air on one day and the war will be ended!"

The airmen, however, began discovering new truths about Air Power at once.

The first great truth to be learned was this: Air Power, at best, is an intermittent power; you cannot apply it continuously. If you cannot apply it continuously, your enemy can repair his installation *almost* as rapidly as you can damage them.

It had not occurred to many persons that a blown up bridge was anything but a demolished bridge; that a bombed factory was anything but a destroyed factory. The airmen soon learned the sad truth that whatever man can build once he can rebuild.

The airmen were forced to alter their objectives: wheras they had set out to demolish a nation, they now began to speak of "attrition." Their more modest objective now was to destroy installations faster than the enemy could rebuild them. They spoke of "forcing the enemy to expend man-hours of labor beyond his capacity." They soon learned that "attrition" works two ways. It takes from 57,000 to 62,000 men to get a 1,000-plane attack into the air.

Beyond this elemental truth, they learned another—an old truth of warfare, to be found in every military textbook: For every new form of attack, a new form of defense can be devised. Threatened with the destruction of their industries, the Nazis moved their machine shops underground and dispersed them. Great damage was done to Nazi production, as the air war advanced—but the Nazi's production means were never demolished. Nazi production continued.

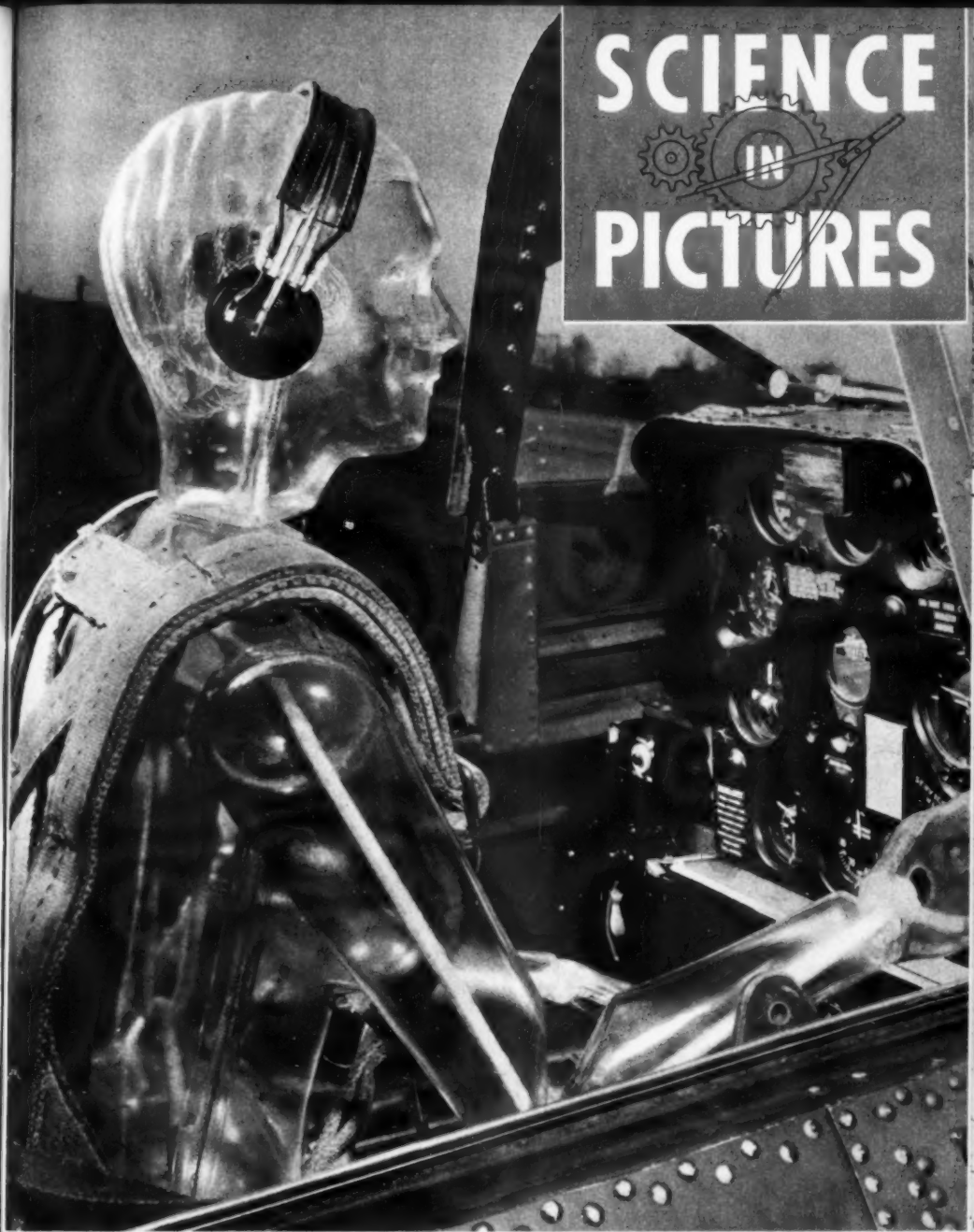
The airmen learned, too, that Air Power, just like sea power, is subject to the weather and to darkness, despite the perfection of all manner of new instruments. These elements, plus others, probably will make impossible, for many years to come at least, the *continuous application of* Air Power which would be essential to any complete air victory.

The second great truth to appear was this: Air Power is not self-contained; it must depend on surface transportation and bases.

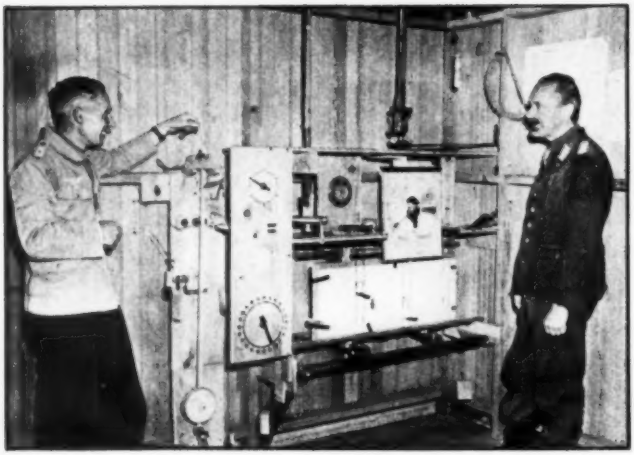
The air war in 1943 faltered and nearly died out because of the success of the Nazi U-boat campaign in the North Atlantic. Before Air Power could really make itself felt, beginning in January and February of this year, the airmen were required to sit back and wait until the Navy had cleared the seas of wolf packs; and lumbering tankers, traveling at 10 or 15 knots, could once more bring supplies to England. Similarly in the Oriental Theater, although General Chennault's air forces in China could be kept alive by air transport "over the hump," still it could never be made a true striking force until the way was cleared through northern Burma for the Ledo Road and the reopening of the Burma Road.

Bases are of primary importance, we discovered. No matter how long the range of a bomber, it must [*Continued on page* 152]

SCIENCE IN PICTURES



THIS GHOST PILOT is a transparent plastic figure representing the average of all the women pilots serving in the WASP. Made from a statue by sculptor G. W. Borkland, the Phantom Lady is used to calculate internal clearances and seat adjustments in planes for the AAF. Transparency permits checking of contact points.



Something From Nothing

USING odds and end of materials, these German officer prisoners of war at Camp Trinidad, Colorado, constructed this wind and weather recording machine. The big dial at the left registers wind velocity. The officer on the left, formerly an instructor in Berlin, claims it will work. Since it's not in Berlin, its efficiency doesn't matter.

Vichy Contributes To The Nazi War Effort

THE Renault Motor Works near Paris used to turn out a famous French automobile. Now they make tiny tanks like this for the enemy, which explains why the RAF and AAF devoted so much time to bombing the factory. The one shown here, captured during the drive through the Gustav Line in Italy, is being tried out by British soldiers.

A Submarine As Small As A Torpedo

WHAT looks here like two torpedoes stuck together is a one-man German submarine (on the right) attached to a full-size torpedo, which can be released in time to permit the pilot to escape. This one landed on Peter Beach on the Anzio Beachhead, and the 17-year-old operator was promptly captured.

A Sea Giant Takes Off From Land

WHEN one of its motors failed in the air, this Martin Mariner was forced to crash-land its twenty tons on Willcox Dry Lake in Arizona. "The Mirage of Willcox Dry Lake," as the plane was called, was turned over to Navy repairmen and Martin technicians, who repaired the motor and hull and installed landing gear, for which they dug trenches under the hull.

Added Fire Power For Navy Planes

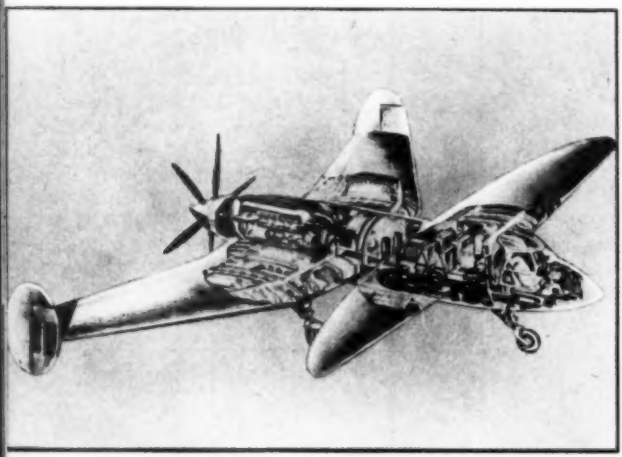
THIS compact, cigar-shaped container houses a powerful machine gun. It's a detachable unit that can be quickly affixed to Navy warplanes, increasing their fire power as much as 100 per cent. Known as the "package machine gun," the whole unit can be dropped in flight if necessary to reduce weight.

Bamboo Pipe-Lines Carry The Salt Of Ancient China

2600 years old, the salt mines of Tse Liu Ching, worked by 300,000 laborers using age-old methods, produce a quarter million tons a year, one fourth of China's total production. Here bamboo pipe lines carry brine solution, from which table salt is extracted, from wells to a refinery. U. S. produced 14,000,000 tons last year.

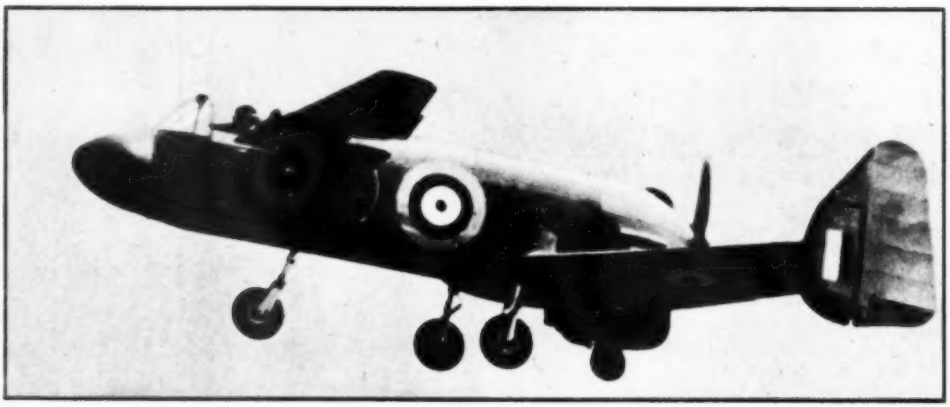
Ingenious New Aircraft Design

BRITISH Designer George Miles drew the plans for this unusual rear-wing plane. This model, the Miles 39, is being tested as a bomber. Though it has three vertical fins and two rudders, the ailerons, placed along the back sides of wing, double as elevators.



Corrigan Should Have Had This

BELOW is a test scale model of the Miles 35, which can fly in only one direction—backwards! Like the Miles 39 (above) it's a rear-wing plane; also, it's a pusher type. It was designed as a shipborne fighter; the peculiar appearance results from a successful attempt to achieve increased visibility for the pilot, and a smaller wing span, both characteristics essential to a carrier-based plane. Plan (left) is for full-sized planes.



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... after

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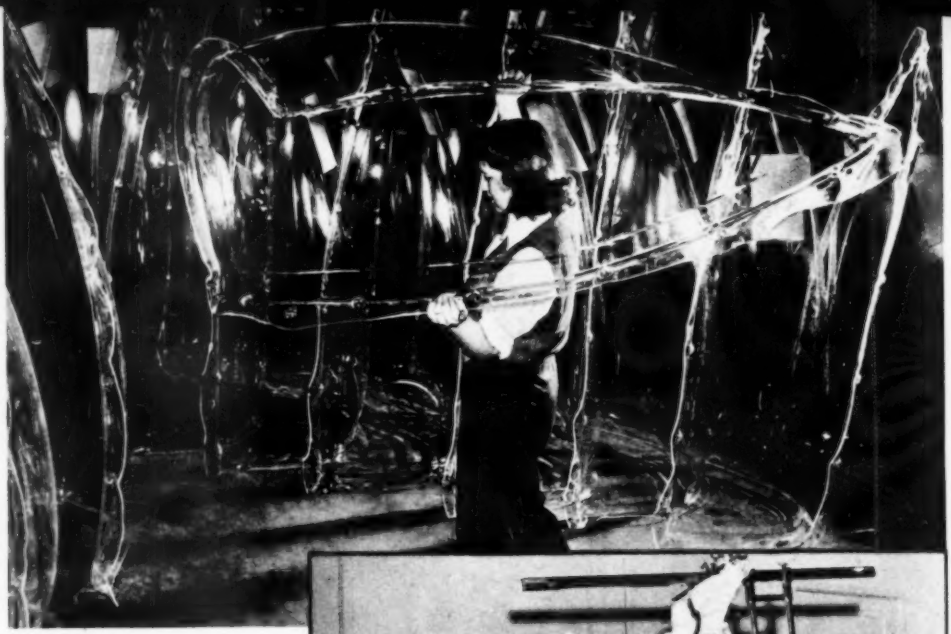
chassis lubrication!

It drives so smooth and effortlessly, fairly soars along — after a MARFAK job. Yes, Texaco MARFAK chassis lubrication is great at making life easy for your car. Because MARFAK is extra tough and longer-lasting, it helps your car *live* longer too! MARFAK is applied by chart, never by chance. From king pins to rear shackles, every point of wear, every point of adjustment is checked when you ask your Texaco Dealer to give your car that "MARFAK feeling." Ask him today!

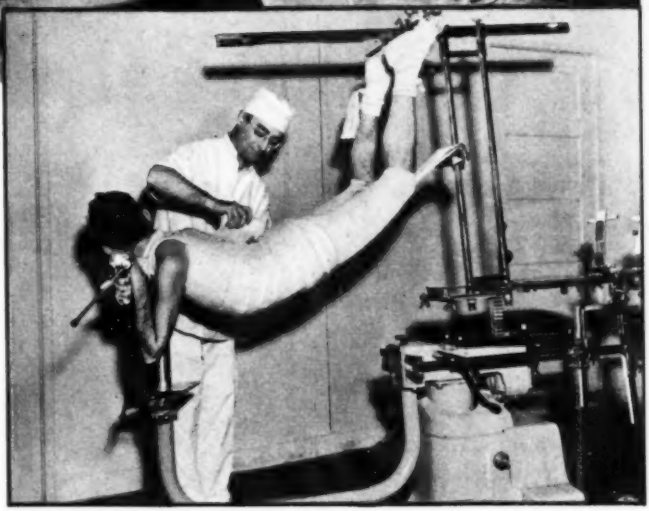
THE TEXAS COMPANY

TUNE IN the TEXACO STAR THEATRE starring James Melton every Sunday night. See your local newspaper for time and station.



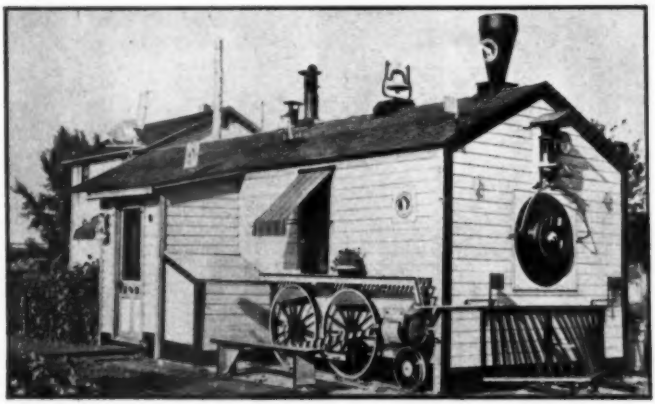
"Bubble" Dance

FEATHER-LIGHT, clear as optical glass, able to take 400 m.p.h. speeds, this Plexiglass cockpit cover gives all-around vision to thunderbolt pilots.



Unusual Cast

THIS soldier patient at a Palm Springs, Cal., Army Hospital is being wrapped in a body cast for a compression fracture of the vertebrae.

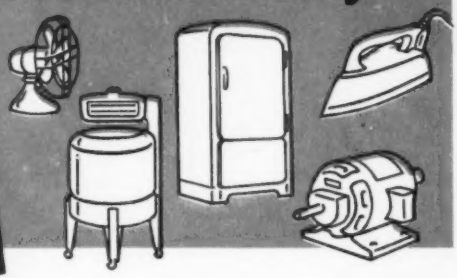


No Place Like A Trainman's Home

TRAINMEN in Noyes, Minnesota, are so fond of the railroads they work on that they decorated this cottage with engine parts. It was made by an ingenious engineer in 1922 from an old box car, and is used by trainmen during layovers. Housekeeping expenses come to only 25 cents a day for each user.

America's War Made Industry—

ELECTRICAL APPLIANCE REPAIRING



OFFERS BIG MONEY

The restrictions on the manufacture of electrical home appliances has greatly increased the need for and earnings of skilled home appliance repairmen. Always a good business, today ELECTRICAL APPLIANCE REPAIRING is one of the most profitable occupations that the average mechanically inclined man can turn to. On many types of repairs it is usual for a repairman to charge on the basis of $5.00 to $6.00 an hour!

PERSONAL INDEPENDENCE

Work as many hours as you wish—for the home appliance repairman is his own boss. Establish yourself in a profitable lifetime business. Operate from your garage, basement, vacant store, etc. You don't need elaborate fixtures or expensive equipment to be a successful repairman. If now in war work, start your home appliance repair business in your spare time and be set with a business of your own when the war is over.

NO EXPERIENCE NEEDED—New Course Tells All

If you are at all mechanically inclined—that is to say—can hold and use tools—then you have all the qualifications required for becoming a big money-earning home appliance repairman. It does not matter if you have not had a great deal of schooling or had no previous training along these lines. Age is no barrier . . . nor is any minor physical handicap.

Read What Other Students Say

I really believe your course the best investment a mechanically minded man can make.—*Claude E. Allen, Indianapolis, Ind.*

Your course on Appliance Servicing is the most complete and up-to-date I have heard of.—*Frank Kremen, Tarentum, Penn.*

I have received your Course in Appliance Repairing and I must say I am well pleased with same. I am only sorry I did not have said Course some years ago. I have learned so much more through this course I would not part with it.—*Charles Schwarz, Hamilton, Ohio.*

The Course in Appliance Servicing arrived a few days ago. Want to take out a few minutes of my valuable time to let you know that this is just what I have been looking for ever since I opened up my Fix-It shop. I must admit that you told the truth when you said that it contains quite a bit more information than I bargained for.—*P. J. Bretl, Sebring, Ohio.*

I am a mechanic for the Western Union Telegraph Co. Three days after receiving the lessons in refrigeration I earned the exact cost of the course.—*Henry S. Lee, Washington, D. C.*

I shall appreciate hearing from you all once more as I would not take $200.00 for my book of lessons.—*Albert Lesli, Denver, Colorado.*

Profusely illustrated, our new course shows you in simple, easy to understand language and drawings how to make each repair on refrigerators, vacuum cleaners, washing machines, motors, etc. Explains and gives you a working knowledge of electricity, welding, nickel plating, etc. Shows you how to build the power tools you need and how to solicit and keep business coming to you. Not a theory course but an honest to goodness course written by and used by repairmen the Country over. Price of course is so low that the savings on your own household appliance repairs will quickly pay for it. Act now!

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British Transport Takes The Air

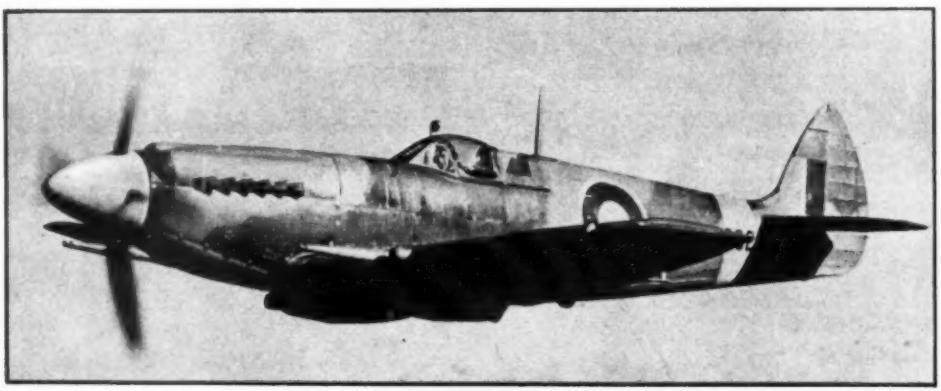
BRITAIN'S famous Wellington bomber served as model for this Vickers Warwick transport, a smaller design used as a passenger and freight carrier in all the theaters of war. Its 45.000 pounds of airworthy weight are powered by two Pratt and Whitney Double Wasp engines of either 1.850 or 2,000 horsepower each.

Leave It To Smith

ONLY very recently were details and photos of the 3" Smith Gun released by the British. Its main feature is its mobility. It can be rolled along very quickly and easily on its solid wheels, which serve as a base when the gun is firing. Light enough to be attached to the back of an ordinary car, it's powerful enough to be an effective weapon in the field.

Latest Spitfire With Its Wings Clipped

BRITAIN'S famous fighter plane is now made in two models, one with extended wing tips for high altitude flying (shown in last month's MECHANIX ILLUSTRATED), and the one shown here with wings clipped for more effective flying at low altitudes.



Fragmentation Bombs

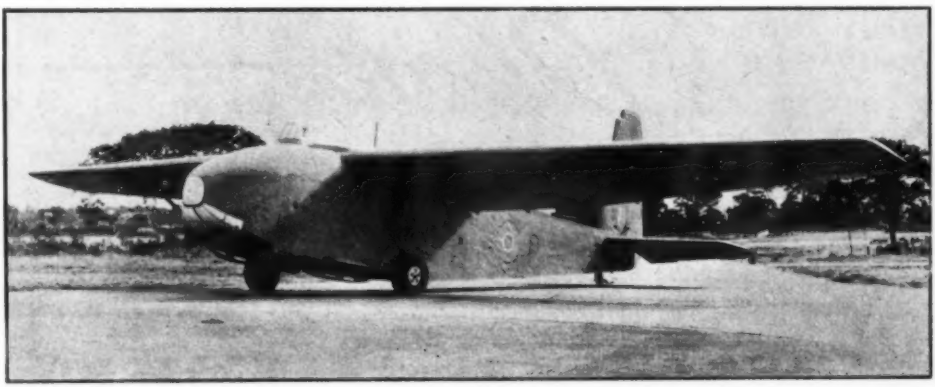
THOSE clusters of what look like sky rockets under the trim fuselage of this Thunderbolt fighter are deadly "fragmentation bombs" which are being used with devastating effect against German aircraft on the ground. Bomb explosion scatters the case in fragments like shrapnel.

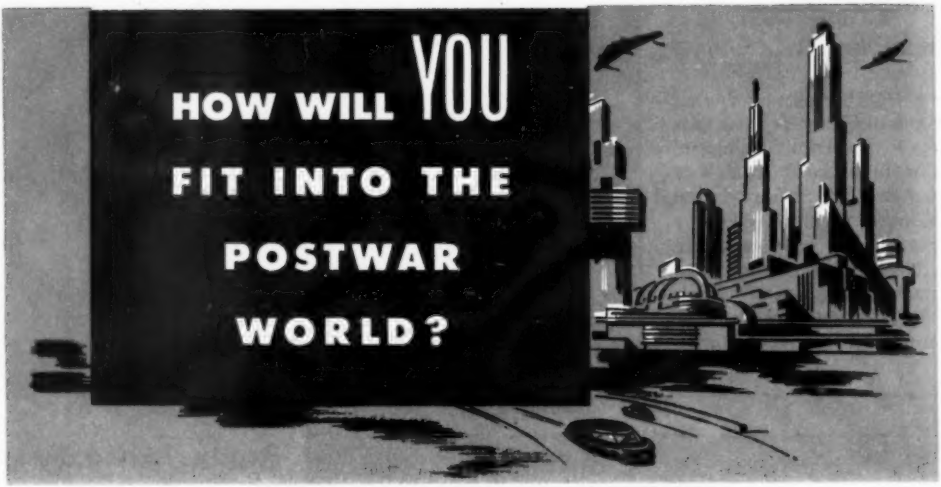
Ready To Go To Berlin and Back

LIEUTENANT J. B. WESTWOOD stands on the wing of his Thunderbolt fighter, poised for a long range bombing mission deep into Germany. His plane is equipped with two light bombs under the wings and a fat, detachable, auxiliary gas tank under the fuselage which will serve him as "second wind."

Hamilcar Crosses The Channel

NOT till the invasion did the British take the wraps off this mammoth tank-carrying glider, which, it was revealed after D-Day, carried light tanks across the English Channel to Normandy. Its wing span exceeds that of the big Lancaster bomber.





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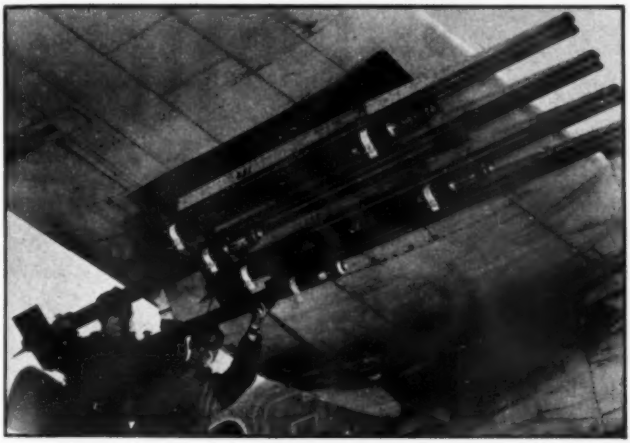
Rockets On Their Way

GAS from the rocket projectiles which have just been discharged from their racks under the wings of this British Beaufighter can be seen obscuring the rudder and elevators of the plane. The Beaufighters belong to the RAF Coastal Command.

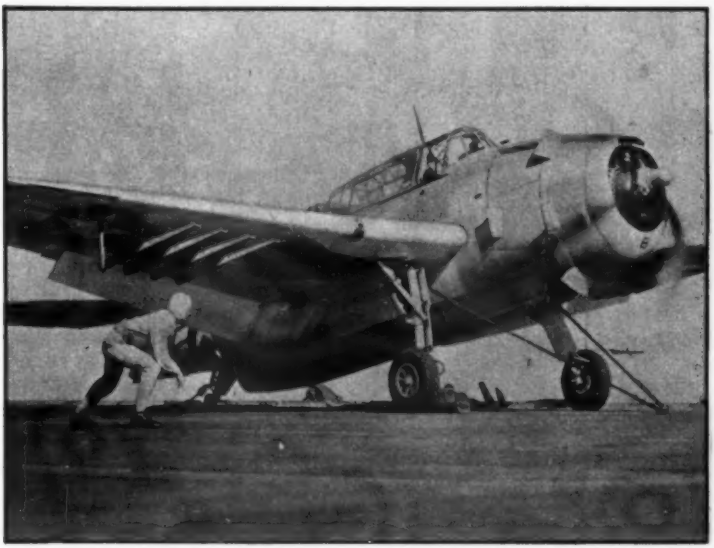


Rockets In Racks

GROUND crewmen load rocket projectiles into the guide rails beneath the wing of a Beaufighter. Four of these rockets are carried beneath each wing and can be fired in pairs, or discharged, all eight together, in one devastating salvo.

The American Version

A GRUMMAN AVENGER torpedo bomber warms up on the flight deck of an aircraft carrier. Its four rocket racks are already filled with their complement of projectiles. These weapons are being used increasingly in the Pacific area.

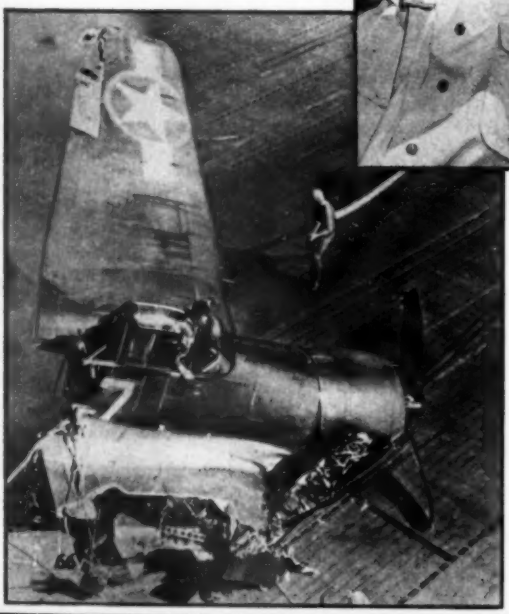


Mobile Electric Plant For Our Allies

PACKED into these unusual railroad cars is a power plant capable of turning out 5,000 kilowatts of electricity from low grade coal. 432 feet long and 640 tons in weight, this power plant, here undergoing tests in New Philadelphia, Ohio will be sent overseas to supply electricity to devastated areas in liberated Europe, where existing power plants have been destroyed or put out of commission.

Nine-Pound Sub-Sub-Machine Gun

THIS new .45 cal. machine gun developed by the Army is probably already in use in Normandy. It's three pounds lighter than the twelve-pound Thompson sub-machine gun, and costs only $20 to produce against the older gun's $40.



This Carrier Landing Is One For The Books

THE pilot of this Hellcat is climbing out of it unscathed after a hair-raising landing. After being shot up over Palau, he headed for home with his hydraulic system gone, his flaps useless, a large hole in his right wing, and his ailerons smashed. His ship side-slipped landing on the carrier and came to a stop minus a wing and a tail. The ground crew found they didn't have to use that hose.

Facials for Furniture

By Roland Cueva

Changing dismal old furniture into charming pieces like the vanity above is easy. Just follow the simple methods of Peter Hunt, well-known Cape Cod craftsman.

IT JUST so happens that Peter Hunt doesn't build mousetraps, but if he did they'd probably be so attractively decorated that even the mice themselves would beat a path to his door! The rest of the world already has. Peter insists that what he offers instead of mousetraps is something that anyone with

Wouldn't think you could do much with this old bull fiddle case—except maybe carry a bull fiddle in it—would you? Well, take a deep breath and glance at the color picture on the opposite page.

This lovely console table and mirror came from the ugly old dresser below, at right. Can you see how it was done? Finish is antiqued, applied over light ivory ground.

a head on his shoulders and two hands at the ends of his arms can get at almost no cost—except the expenditure of a bit of effort and ingenuity.

The quiet, congenial Peter Hunt, a New Yorker by birth but a Provincetowner by adoption, never studied art in the conventional sense; that is, he never went to art school. He did, however, do some traveling in Europe, and what he saw there so impressed his observant, artistic nature that it formed the basis for his idea—an idea that has brightened up the homes of thousands of Americans and has brought to Peter himself an unexpected fame. Peter Hunt watched with delighted eyes the humble, uneducated European peasant transform dull, dead pieces of furniture into things of beauty, sparkle and life, all by means of a little paint applied in unsophisticated, primitive design.

Why, thought Peter, cannot the average American enjoy this type of bright, original furniture in his home—do the job himself—if these peasants, unschooled in the arts or much of anything else, can do it? The secret, of course, lay in that very fact; these people, unaffected by outside cultural influences or the advertising of Grand Rapids furniture manufacturers, were able to put complete self-expression in their work. Their designs were entirely the products of their personalities, worked out spontaneously, as a child or a Mexican Indian

The classic piece seen opposite in color also sprang from this dresser. Leaf design is typical Hunt decoration, made in simple brush strokes.

A few shelves and some red and white enamel perform a magical metamorphosis on the fiddle case, which becomes an unusual whatnot.

might do it. Colors invariably brilliant, used without fear or restraint, gave results that were gay and striking. Often the design would tell a little personal story in simple, recognizable symbols; always a few basic strokes of the brush carried out the pattern.

Peter returned to Provincetown full of excitement and enthusiasm, to experiment with his idea. He rounded up a large pile of junked furniture, most of it given to him by people who were glad to clean their attics and cellars of eyesores that had been lying around unused for years. A few weeks later many of these same people were clamoring at Peter's front gate, wanting to buy back their old pieces, which by some magic had suddenly become attractive and desirable.

The idea was such a success it almost turned into a stampede. Word began to spread around that a man in P-town (as the natives call it) was making something out of nothing, an idea that always intrigues everybody, particularly when the something was as good as this. *Life* magazine ran an article about him. People started bringing their old furniture to Peter, begging him to do a job on it for them. His answer was always the same: "Do it yourself; you can make just as good a job of it as I can, and you'll get a lot more satisfaction from it." Then he would patiently and at great length explain to them just how to go about turning grandma's sewing stand into a gayly decorated end table and magazine rack.

The formula is so simple you'll probably be skeptical until you actually try it. Peter Hunt has gone a step further than the European peasant in one respect—and a very important one from the average person's standpoint. That step is the conversion of ugly, useless pieces of furniture into

Legs were cut off the dresser and modern handles added. Rest is simply stylish paint job, selection of proper mirror and decorative knick-knacks.

Mechanix Illustrated wishes to express its appreciation and thanks to E. I. Du Pont de Nemours & Co. for their cooperation in providing the photographs and information for this article. Their illustrated booklet on Peter Hunt's work, "Transformagic," may be obtained from your local Du Pont paint dealer.

A battered old school desk is converted into a handsome book trough and smoking stand with nothing but paint, saw and screwdriver. Top was sawn in half (after removing iron legs) to serve as sides. Holes were bored for pipes. Red and white Duco, with simple decorations, complete job.

something modern and functional. Where the peasant was generally concerned only with decoration (aside from the original building of the piece), John Doe has that old stuff in the attic—he wants to do a double job, transforming *and* decorating. Of course, he may also have, or obtain, some pieces that need nothing but the decorating, and there are always many small items, such as trays, bottle, plates, etc., lying around that would be greatly improved by a dose of Dr. Hunt's non-secret formula.

Assuming that you're going to start with

Heavy picture frame or mirror makes ideal coffee table. If frame is used, cut a piece of plywood to fit opening. Legs may be taken from an old chair, or you can make sawbuck legs, as in photo. An antique white finish (applied over undercoater) with blue or pink scallop decoration is nice.

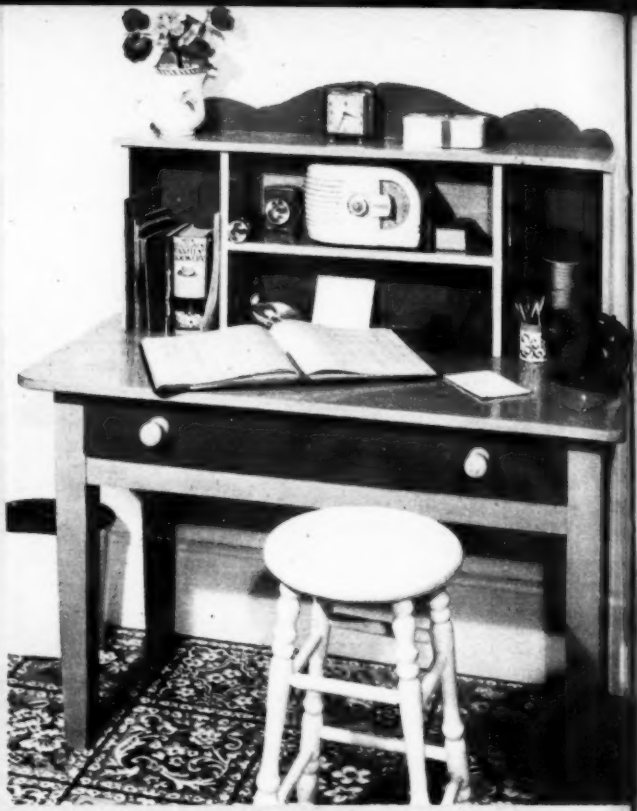
a major or minor operation on some hideous old relic, and then proceed with the facial, here's Peter's advice:

Always allow the nature of the piece itself to determine what its new role is to be. Usually something will immediately suggest itself, and can then be aided and abetted by your own ideas and requirements. Complicated or involved alterations are to be avoided, and nine times out of ten are unnecessary. Generally nothing more drastic than sawing off a few legs, or adding legs and new knobs or handles is needed. If you're at all handy with saw, drill and screwdriver you should have no trouble; if not, just stick to the decorating part and let some other more carpentry-minded member of the family accomplish the joinerwork. Several examples of easy but clever Hunt conversions are illustrated here to give you the idea.

Only three things are required for the execution of such attractive decoration designs that you'll be amazed at your own, perhaps unsuspected, artistic cleverness. You can be a combination Duncan Phyfe and Michelangelo with the greatest of ease. Good paint, a good brush and the learning of a few simple, basic brush strokes will turn the trick. Get the paint (oil colors) in bright, bold colors; vermilion, chrome yellow, cobalt blue, chrome green. These colors are used both for painting the designs and for tinting the background paint to the desired color by mixing with white enamel. A flat undercoater must naturally be used beneath the finish coat of enamel. After the decorating has been applied, and thoroughly dried, a coat of clear varnish may be brushed over all.

Once you have learned the basic strokes (illustrated)

Above: Here's how you make clever little figure and house designs. In each figure a circle forms the head, a heart part of the body. The man has an inverted heart for trousers. The large masses are painted first, the small details added afterwards. Faces and hands are pink. Woman has yellow skirt, red bodice and blue hair. Man has red trousers, blue jacket, yellow hair and stockings. Development of house is very simple. Roof is red, wall yellow, shrubbery green. Drawings below show how vegetables are made. Grapes and pineapples start the same way. Carrots, radishes, pears are painted just as they look, but flat instead of round. With practice you'll be able to make all these decorations, and more of your own.



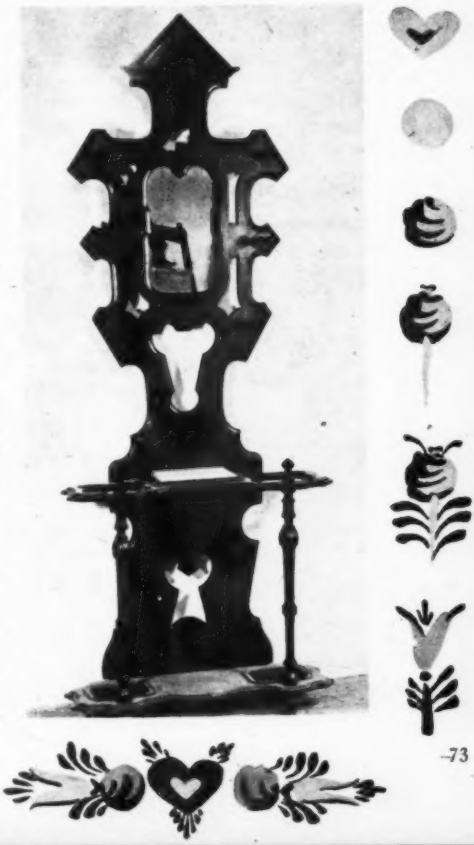
This beautiful bath vanity was made from the old hall rack shown on opposite page. Bench was worn out one from old dresser, recovered with bath towel.

Here's a job that was just straight painting. The old derelict opposite blossomed into a good-looking desk. Below are household objects brightly decorated.

An undercoater sealed pores and grain of the wood, allowing the Duco to lie smooth and glossy. Design below was made up from the vertical row of figures.

you'll be surprised at the facility with which you can turn out beautiful, original patterns. You'll also find that you have all the unsophistication of the peasant cousin, if you'll only allow it to come out of hiding. One thing you must never do is to copy anything—always follow your own inclinations of expression. Chances are it'll be so much fun that you won't dream of copying anyway. In addition to the designs, you can write an occasional sentiment on a piece, "brush-writing" it in your own hand. You needn't be afraid of making a mistake, for the thing can immediately be wiped off clean as a whistle and repainted. Keep a soft, absorbent cloth handy for this purpose when you're painting.

A palette is used to mix the paints—it can be an old board, magazine or piece of glass. Mix your colors recklessly according to your notions—the only thing to avoid in this respect is "muddy" color; stay away from browns, olive tints, etc. Clear reds, yellows, green and blues give the most pleasing results, particularly when the background color is white or antiqued. The latter process is very easy—you can learn it in ten minutes. Actually, all it consists of is the brushing on of an "antique glaze" over the background surface, then wiping most of the glaze off, leaving just enough in depressions and around edges to



Peter Hunt at work. He can completely decorate a piece this size in about a half hour. Note position of hand. Below: Basic stroke is teardrop. All others are variations.

Here Is What I Do

by Peter Hunt

1—After making any necessary alterations, prepare surface for painting. If old finish is bad I remove it with scraper or paint remover. Then sand wood well with No. 1/0 sandpaper.

2—Apply flat white undercoat. This seals pores and grain in wood, gives good base for enamel finish.

3—Sand again with No. 3/0 sandpaper.

4—Apply finish coat of enamel or Duco in desired color. If very pale tone is wanted I use white enamel tinted with oil color. Use 1½" brush of good quality.

5—Allow 24 hours drying time, then start my designs, using oil colors in tubes and a ¾" sable brush, pointed. Four brilliant colors and white are enough; in between shades are obtained by mixing colors on palette. Here are the colors: American vermilion, Chrome yellow-light, Cobalt blue, Chrome green-dark.

6—When designs are dry, apply coat of clear varnish over all.

give that mellow, aged look to the furniture. Antiqued pieces have the advantage of harmonizing well with modern, sophisticated natural-finished furniture in almost any type of room. To make an antique glaze obtain some clear varnish, turpentine and a tube of raw umber oil color. Mix 3 parts turpentine with one part oil pigment, then add one part varnish and stir well. That's all there is to it, aside from the brushing on and wiping off. Antiquing looks best on light-colored pieces, particularly when there is carving or molding present. You can get nice dark tones in the hollows and rich highlights on the high spots. When the glaze has dried it's a good idea to apply a coat of clear varnish, as in the case of the decorations.

Don't try to save money when buying brushes. If you want to do good work, nothing less than the best brush available will suffice. Get either [*Continued on page* 142]

An old bureau was converted into this Welsh cupboard by addition of plywood, scalloped top section. Chair was decorated to match.

The flying photographers shoot 75-lb. camera guns, are supposed to come back with at least the handles and films in one piece.

Mata Hari with a Glass Eye

By Lt. Donald H. Telford, USNR and Beryl D. Kneen

"Super Sleuth of the War"—that's what they call the lad with the aerial camera.

THE secret of Truk, "impregnable" Japanese bastion of the South Pacific, is out at last. Aerial photographs did the trick.

Hidden from outside eyes for more than a quarter of a century—since the mandate passed from German to Japanese control after World War I—Truk's mysteries first were

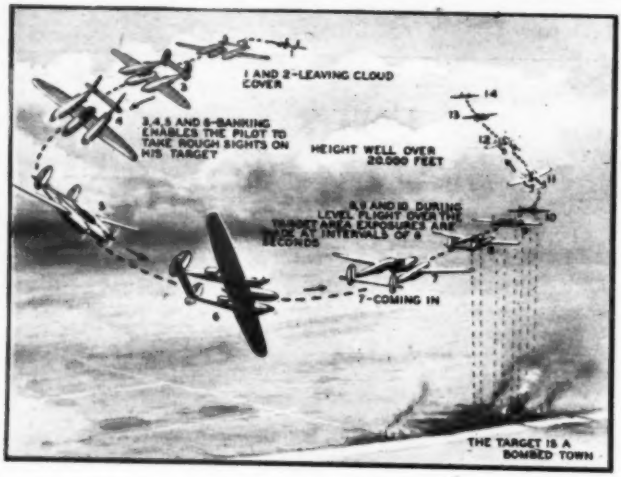
This aerial shot of Wewak, New Guinea, revealed (1) trenches connecting guns with command post, height finder, (2) heavy AA guns, (3) gun crews, (4) gunners' living quarters, (5) laundry on lines. Picture wasn't so neat after bombs messed it up.

Photo from Lockheed

Above, latest thing in Navy camera-toting craft, the F-5. It's the Army's old standby, the P-38, stripped of guns and mounting a battery of five cameras.

Below, a full-color reconnaissance shot of a Jap-held atoll in the Marshalls. From color shadings experts can locate reefs, plot invasion channels.

SIGHTING VERTICAL SHOTS: Here's how a camera-laden F-5 wings in over its photographic target. First, the pilot banks, taking a rough sight. Then he levels out to take exposures at six-second intervals.

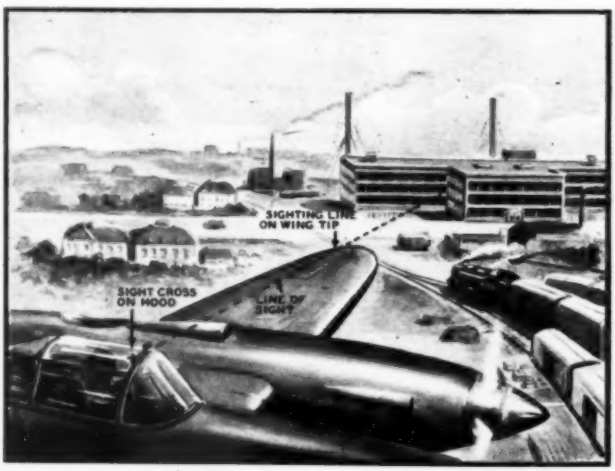

1 AND 2-LEAVING CLOUD COVER
3,4,5 AND 6-BANKING ENABLES THE PILOT TO TAKE ROUGH SIGHTS ON HIS TARGET
HEIGHT WELL OVER 20,000 FEET
8,9 AND 10 DURING LEVEL FLIGHT OVER THE TARGET AREA EXPOSURES ARE MADE AT INTERVALS OF 6 SECONDS
7-COMING IN
THE TARGET IS A BOMBED TOWN

revealed to the waiting United States Pacific Fleet on February 4, 1944, when 22 intrepid young naval aviators of the United States Marine Corps flew their B-24 Liberator photographic planes on this most dangerous mission. They were led by Maj. James R. Christensen, USMC, of Salt Lake City.

This history-making photographic assault preceded the actual carrier task-force battering ram by twelve days and procured the information necessary to send American planes and ships into action against Japan's "Pearl Harbor" at daylight on February 16, 1944.

Super Sleuth Number One of the present war is the aerial camera. Here is another typical tie-up between camera reconnaissance and effective action that I witnessed out in the South Pacific theater where I was a Navy photo-interpreter for fourteen months. One day a camera plane came back with a roll of film covering the airfields on South Bougainville Island, Solomons. On this particular day, the photographs showed 135 bombers, dive bombers and fighters on Japanese-held Kahili Field, and revealed 95 fighters on near-by Ballale Island fighter strip.

From photographs and other sources of information it was obvious to air intelligence on Guadalcanal that a Jap attack was being planned on American bases. The specific information that our stereoscopes helped us pick out on those two fields enabled our air forces to be ready for the enemy. On April 7, 1943, the enemy started to come over Tulagi Harbor to attack our shipping, not guessing that the size and character of his force were already known and planned for. Our fighters were up and made contact with the Jap planes slightly north of their planned target. The surprise was complete; our force was strong enough and the Japs were forced to scurry for home, losing over two-score bombers and fighters before they fled, defeated. This is only one of the major air battles where the camera sleuth delivered the goods.



SIGHTING OBLIQUE SHOTS: In this case the pilot sights his target from a cross marked on the hood of his cockpit. His sight line extends out to the wing tip. The F-5's cameras are all automatically operated.

Photo-interpretation was developed in the early stages of the war by the British. Flying over Germany they began to use cameras to pick out targets for bombing, to watch for signs of invasion attempts on Britain proper, to assess the assemblages in freight or marshalling yards, to detect troop movements, to find antiaircraft and

coastal defense gun batteries and in general to keep their eye on the enemy and his movements. When the British were able to begin bombing Germany in force, their camera planes recorded the damage that had been done to industries and other military targets and helped them improve their night bombing and evaluate its results. Sometimes, of late, good bomb damage photos of Berlin are not available for several days until the smoke has cleared away.

Commander Robert S. Quackenbush, Jr., USN, studied the British system in England and set up a school for photo interpretation at Naval Air Station, Anacostia, D. C., in 1941, for the Navy and Marine Corps. The Army has one at Harrisburg, Pa. All services have built up photo interpretation from the ground floor and have accomplished a great deal since they started. I was in the second class graduated from Anacostia in April, 1942, and went out to the South Pacific theater immediately afterward, returning 14 months later to teach the use of aerial photographs to naval aviators in operational training at the Jacksonville Naval Air Station.

In the early phases of photographic interpretation in the South Pacific, Navy and Marine Corps photographers used Army B-17's because aircraft were scarce and the B-17 was about the only fast, long-range plane in the area.

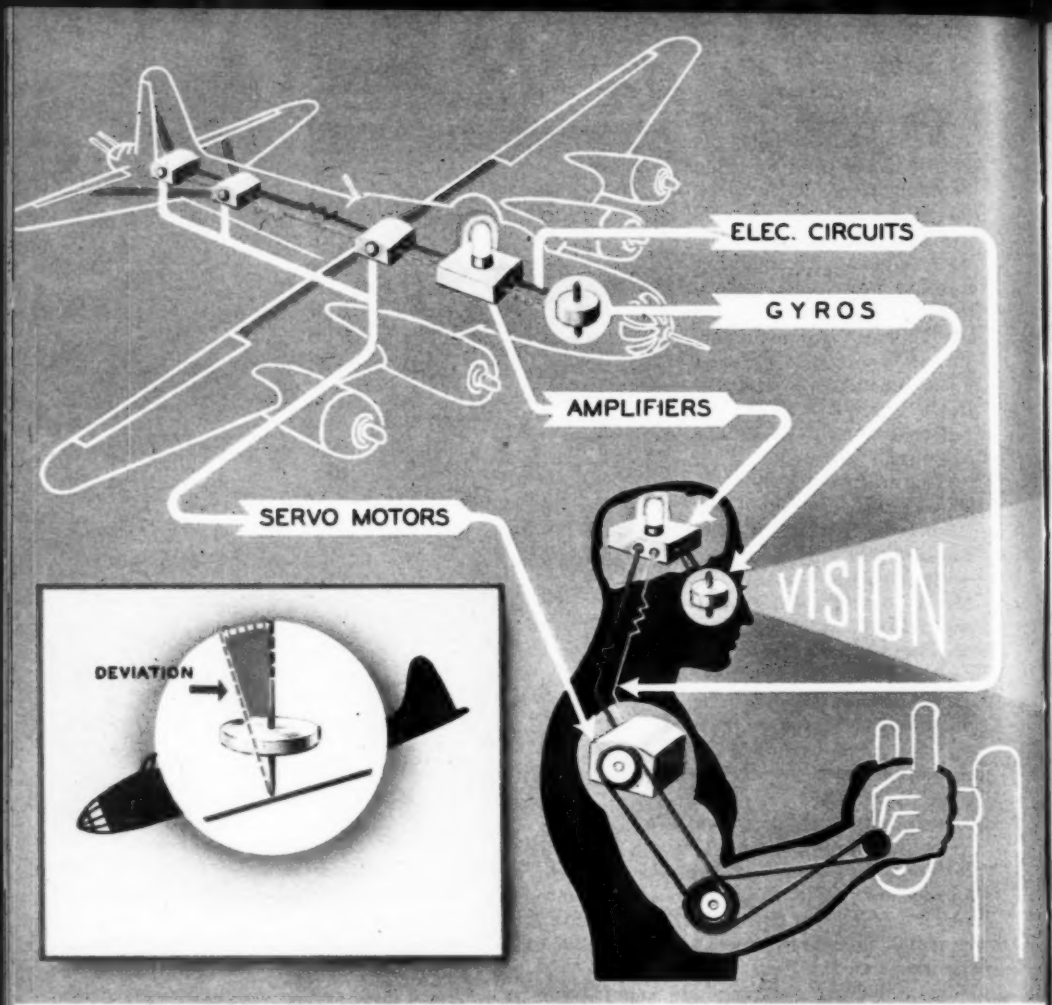
Once the picture of enemy terrain is taken and printed, the job of the photographic interpreter begins. With our stereoscopes we look over the work of our photographers to see what the "Mata Hari With the Glass Eye" has found in the hostile camp.

Photo interpretation may be divided roughly into four phases. The first phase is what we call in the radio and newspaper business, "spot news." That is getting the "word" to our forces in a hurry for quick action. This first phase interpretation is concerned with information that will affect the course of the war within 24 hours. The incident which I have cited of the detection of the Japanese aircraft in force on Bougainville is an example of first phase photographic interpretation.

Photographs of bombed areas, shot with 60 percent overlap, appear three-dimensional when viewed through stereoscope.

The second phase of photo interpretation is a little less urgent. This includes the detection of such enemy installations as coastal defenses, searchlights, barbed wire on invasion beaches, antiaircraft batteries and any changes in the pictures of today as compared with those taken of the same area yesterday. For example, pictures taken of Tarawa showed the barbed wire entanglements on the beaches, which warned the forces coming in of what they would have to take care of in making the landings. Noting day to day changes in enemy positions and conveying the information to our air, sea and ground forces is probably the largest phase of photo interpretation.

Second phase work includes gathering such information as length of enemy air fields, measurement of antiaircraft positions to determine whether they are heavy or light, and the identification of ships and aircraft by measuring them and [*Continued on page* 144]



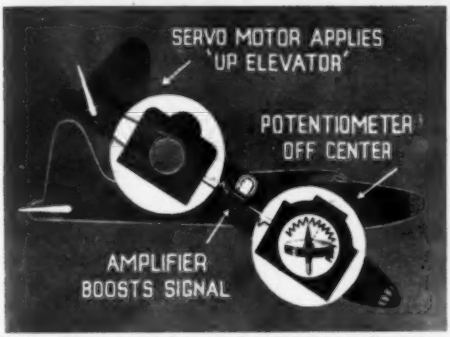
The automatic pilot is much like a human pilot: the gyroscopes are the eyes, the amplifier is the brain, the electronic balancing units are the nerves, and the servo motors are the muscles.

Third Pilot

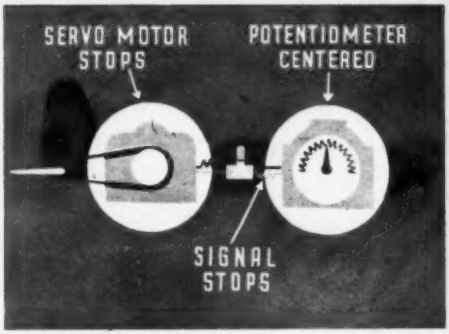
Disney films instruct AAF fliers in construction and use of the automatic pilot.

THE story of the electronic automatic pilot—"George" to the men who fly with it—now standard equipment on all the AAF's four-engined bombers, has recently been released by the Army. The charts you see on these pages are based upon those used in films made by Walt Disney to instruct AAF flying personnel in the construction and use of one of the most valuable new devices of this war.

High-altitude precision bombing, with which the AAF has achieved an amazing record of pin-pointing its bombs on military objectives, would be impossible without the electronic autopilot. When a bomber reaches the climax of its mission, the bombing run over the objective, the human pilot turns over control of the plane to the autopilot, which holds it dead on its course with inhuman steadiness and accuracy during those vital seconds when the bombardier is taking aim and releasing his missiles. A deviation of one degree from the set course means failure; at 25,000 feet, an error of one mil means that the bomb will miss the target by 360 feet. Capable of making 300 flight adjustments a



If plane's nose goes down, potentiometer needle moves off center and a signal is sent through boosting amplifier to servo motor, which raises plane's elevator.



On reaching level flight the potentiometer is again centered and signal stops. Two gyros control pitch, roll, and yaw movements of plane, keeping keel even.

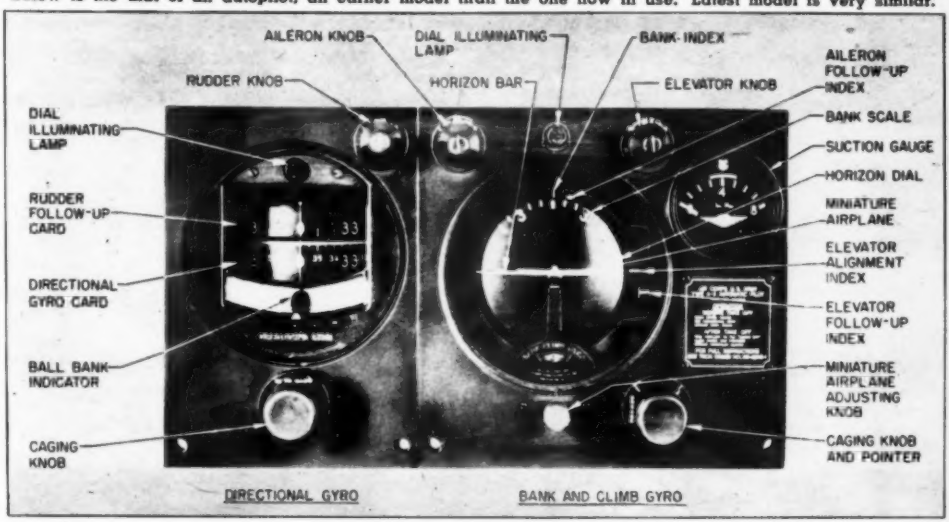
minute or five every second, the autopilot guarantees the highest possible degree of accuracy, and gives the bombardier a steady platform on which to make his delicate adjustments of the Norden bombsight.

The autopilot is not new—it has been used for over a decade by the commercial airlines and has flown planes from New York to Chicago hundreds of times—but it is the application of electronics to the original device by engineers of the Minneapolis-Honeywell Company which gives the Third Pilot its present accuracy and speed of adjustment.

The essential part of most automatic pilots, including this electronic one, is the gyroscope. Set in a case which is fixed rigidly to the plane, it remains always parallel to the earth's surface while the case changes position as the plane dives, climbs, or banks. Deviations from level flight are measured electronically by a potentiometer which transmits impulses to servo motors through amplifiers which strengthen the signals. The servo motors in turn move the control surfaces (ailerons, rudder, etc.) in such a way as to bring the plane back to level flight.

Use of the Third Pilot, of course, not restricted to bombing runs. It has been a Godsend to tired pilots flying their heavy bombers back from missions; and with the addition of remote control stations, planes can be flown from several positions. Bombers have been flown home by bombardiers after control cabin personnel have been knocked out, and an Eighth Air Force officer recently home on leave told of more than 50 Flying Fortresses which safely returned to their bases with their manual control cables shot away.

Below is the dial of an autopilot, an earlier model than the one now in use. Latest model is very similar.



Told by a *Bomber*

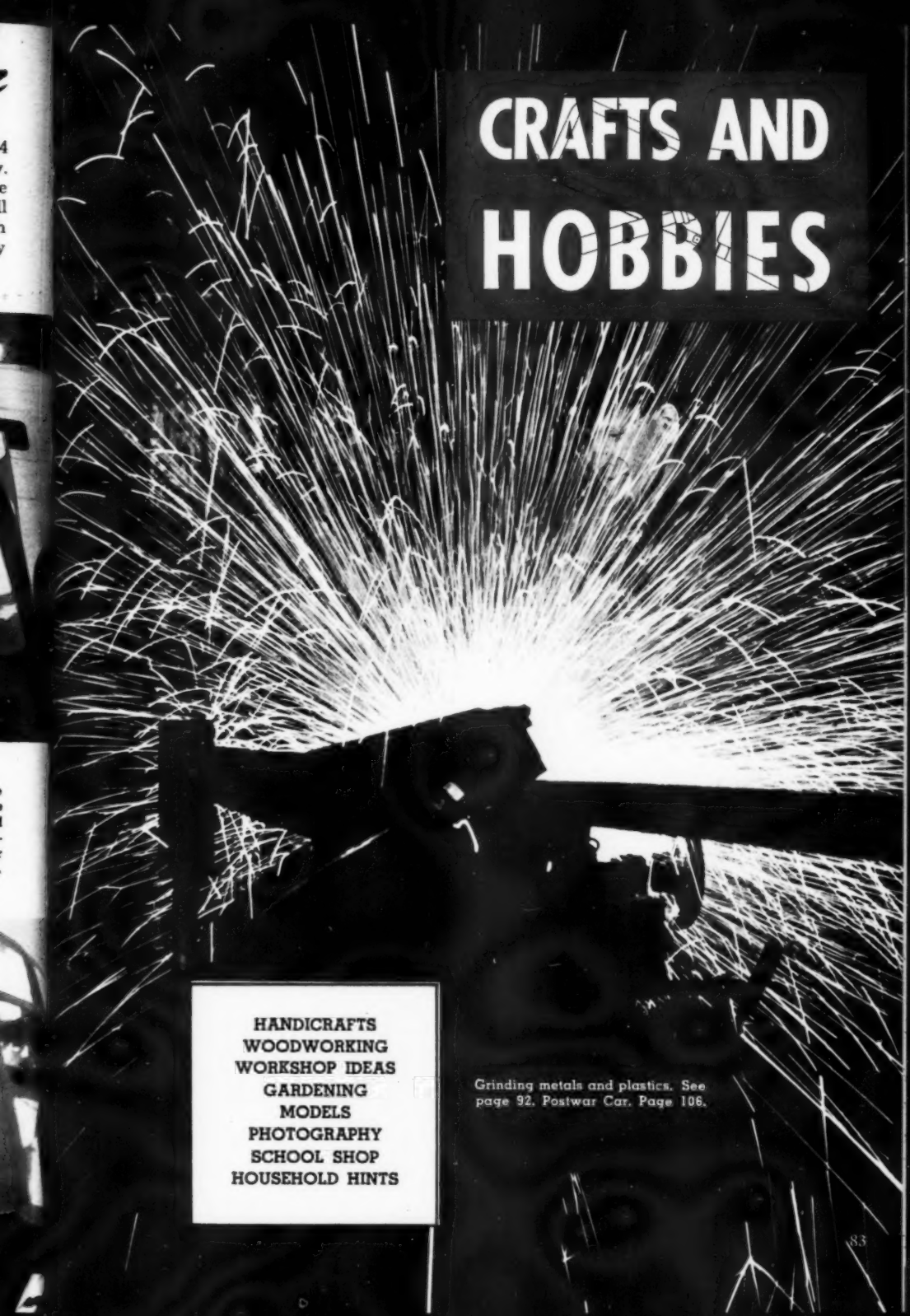
"THE SQUAW," a flak-scarred B-24 Liberator bomber, tells her own story. She's literally the most decorated ship of the war. From her heavy warpaint you can tell where she flew on her 71 missions, which crew members won her 70 medals, how many tons of bombs she let fly on targets.

Above, the veteran bomber with one of her most recent crews. She saw her personnel change many times over during her long service in the European Theater. Right, a crew member points out one of The Squaw's many targets. She flew far enough to circle the globe four times plus.

Left, three of The Squaw's proud crew members line up before the ship's many decorations. These include one Congressional Medal of Honor, two Distinguished Service Crosses, four Silver Stars, two Soldier's Medals, 27 Distinguished Flying Crosses, and 34 Air Medals. Irregular splotches show many flak hits.

Right, a crew member ogles the shapely squaw who adorns his ship. In upper lefthand corner can be seen some of the 71 bombs which mark completed missions. The Squaw dropped 360,000 pounds of TNT in one year, on many European key spots including Ploesti oil fields. Famed Col. John (Killer) Kane piloted her for some time.

CRAFTS AND HOBBIES



HANDICRAFTS
WOODWORKING
WORKSHOP IDEAS
GARDENING
MODELS
PHOTOGRAPHY
SCHOOL SHOP
HOUSEHOLD HINTS

Grinding metals and plastics. See page 92. Postwar Car. Page 106.

Boy's Desk and Table

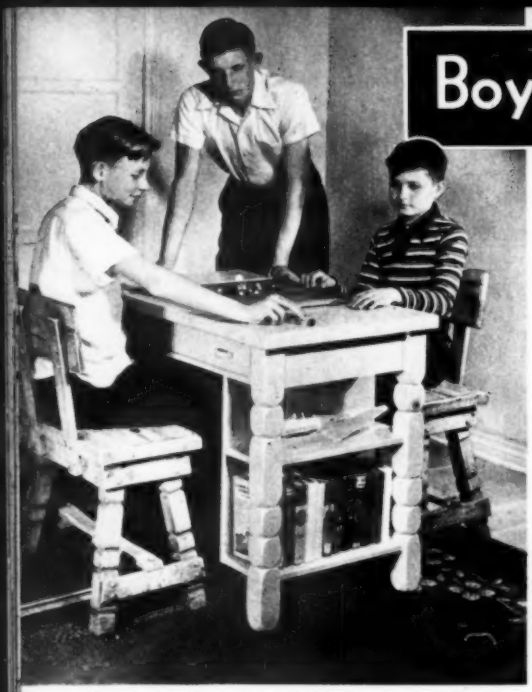


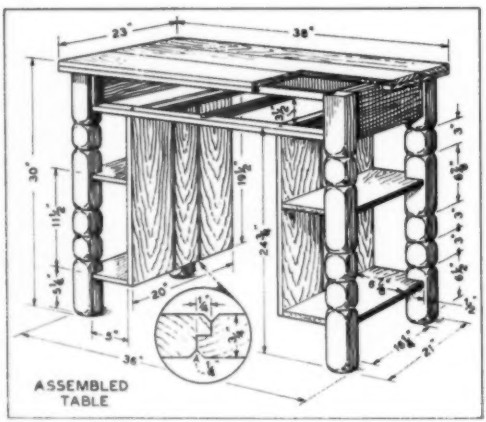
Table shelves may be used to hold books or models.

Desk is fine for homework: drawers hold materials.

Simplicity that suits a boy's taste, and sturdy rigidity that bears up under rough handling, characterize this desk and table.

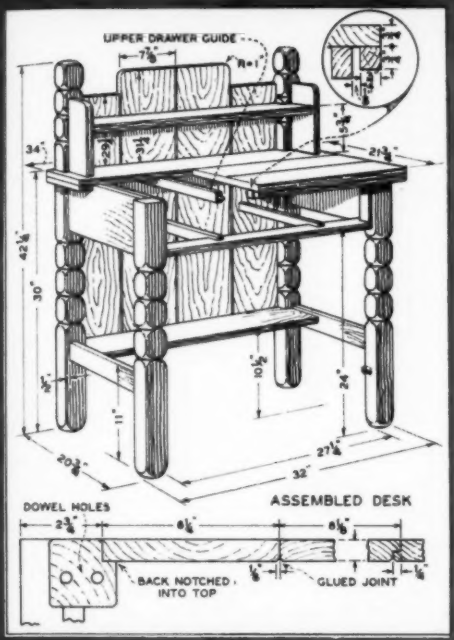
by Edwin M. Love

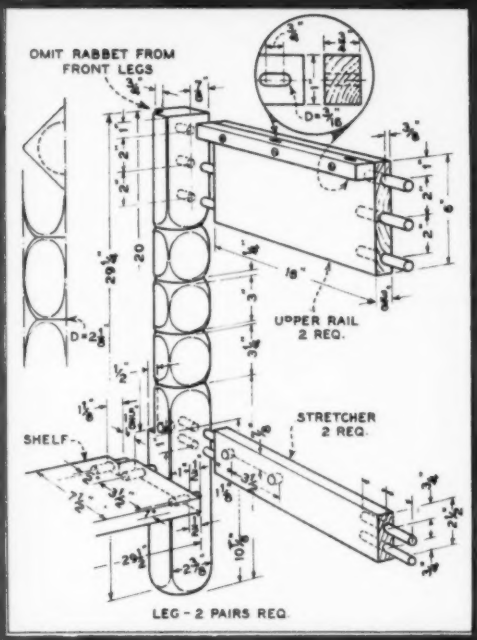
SOLID lumber is specified in the material list, but if ¾" plywood is obtainable, use it to make the tops and shelf backs, the single pieces eliminating joints and the danger of shrinking, swelling, and warping. Make vee grooves in plywood by cutting shallow saw kirfs and chamfering the arrises with a hand rabbet plane.



To build the desk, cut the stock according to the list. Select the boards for gluing, arranging them with heart and sap sides alternating and the grain through the thickness running in the same direction in each piece for ease in planing. Label the mating pieces. Since freshly cut ends are prone to shrink, rack the pieces on stickers (¾" strips between boards) to stabilize the moisture content of the wood.

Joint the legs square and pair them, marking the best sides for working faces to be turned outward. Center them accurately on the lathe and turn the arrises to make chamfers about ⅛" wide. Mark the bead divisions on two faces with a soft pencil. They will show as distinct gray lines when the lathe turns.





Score these lines deeply with a skew chisel and turn the beads with the skew resting on the long edge, long point down. Swing from a position parallel to the piece into a position nearly at right angles with the axis. The faces of the turned beads should show semi-circular ends.

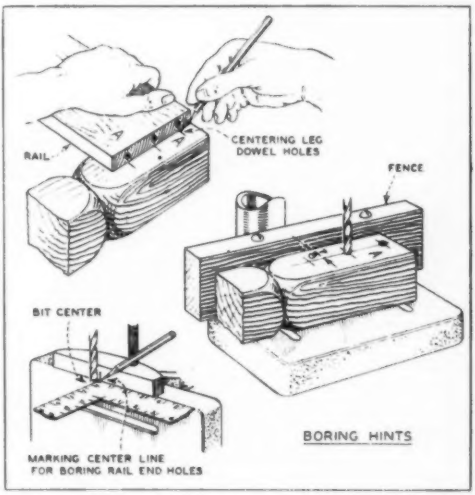
Rabbet the back legs and shelf posts to receive the back boards. The upper post rabbets should have square ends to fit the back.

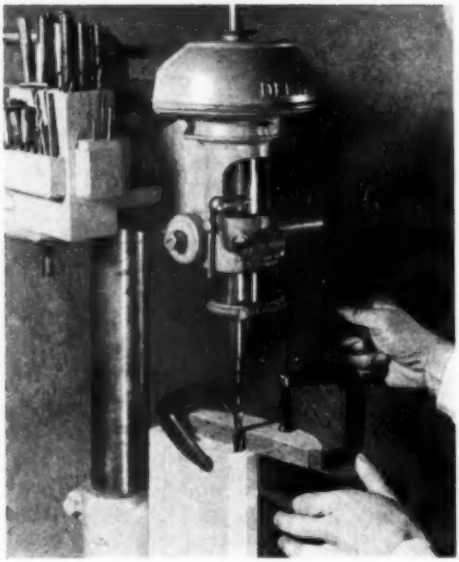
Bore the end rails for dowels as indicated in the photograph. Adjust the table by swinging it on the column ⅜" from the center of the bit. Pair the rail ends with the legs, marking them with letters, and mark the positions of the dowel holes by laying the rail on the leg. Use hardwood dowels throughout. Chamfer the ends and cut a shallow groove down the length of each to allow imprisoned glue to escape. Be sure there is bottom clearance in the holes.

Glue and screw the cleats used to attach the top.

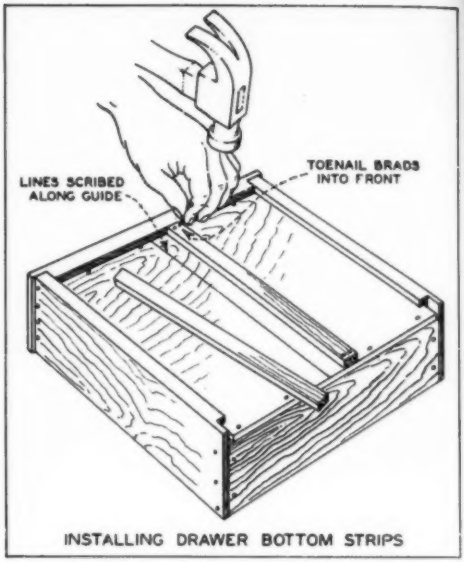
When making drawer rails, note that the upper one houses into the tops of the legs while the lower one notches around them and has a screw through each lapping tenon. Dowels support the front edges. Assemble the end frames with the front rails and lower shelf, and tack a strip across the back at the top. Square the assembly and nail a temporary diagonal brace beneath the rails.

Now joint the boards to be glued and dowel them together. While they dry, make the drawers. Groove the fronts and sides to take the bottoms, as in the drawings. Rabbet the parts and assemble by nailing the sides to





Drill press setup for drilling holes in the rail ends.



Tack wooden strips on each drawer along guide lines.

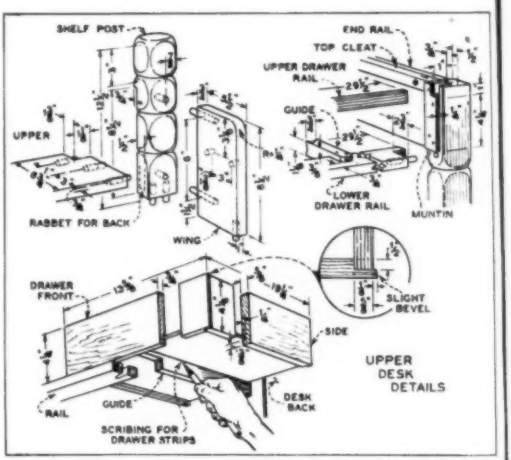
the fronts and the backs to the sides, square them, and slip in the bottoms. Drive a brad or two through each bottom into the front, and nail to the lower edge of the back. If paper wallboard is used, drive three or four nails into the fronts to prevent sagging of the bottoms.

Square the top and glue on the false edging. The front edging must show ¼" clearance between it and the drawer rail, as indicated, to allow for shrinkage. Build up the ends with pieces cut across the boards so that they will shrink with the top. Paint the inner edges immediately to prevent checking. Screw the top in place, solidly at the back, just tightly enough at center and the front to take up slack. Smooth it to a level surface.

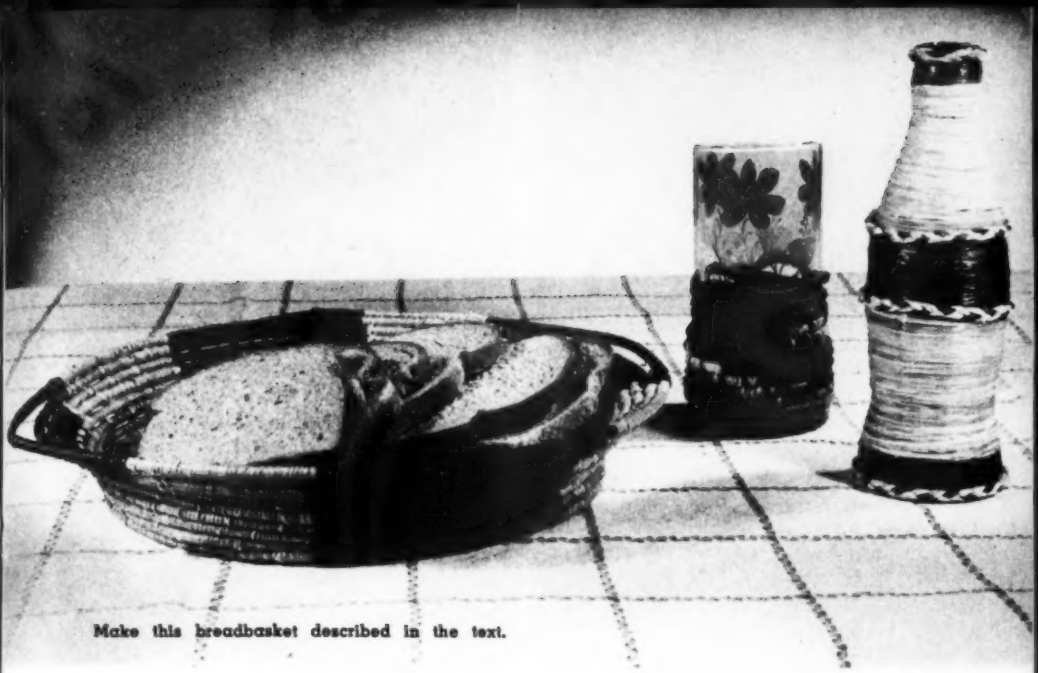
Make the back boards, rabbeting the inner edges, and fit in place. Secure them to the bottom shelf and desk top temporarily while the posts, upper shelf and wings are glued in position. Put in the muntins at the ends of the drawer opening and fit the guides. Glue the front ends, square them with the rails, and tack to the back. Then bore dowel holes through the back into their ends. Place one drawer accurately and trace along its bottom each side of the guide, using a sharp pencil. Guiding on these lines, tack on wood strips ⅜" by ¾", nailing them at both ends. Less than $\frac{1}{16}$" clearance on the guide is needed. For a final fit, bevel the tops and ends of the front, showing about $\frac{1}{16}$" clearance with the upper rail and leg. Then fit the other drawer. Bore screw holes for the drawer handles, placing them slightly above center.

Before painting, chamfer all exposed arrises about ⅛", working into corners with a cabinet file.

Remove the desk back and paint the board, not neglecting the rabbets which would otherwise show bare wood after shrinking. Paint the rest of the desk, and when finishing is complete, install the back permanently, this time screwing it to the upper shelf as well as the desk top and [*Continued on page* 132]



Details of desk top. Note scribing for drawer strips.



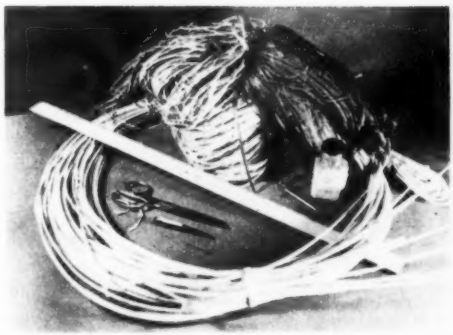
Make this breadbasket described in the text.

Photos by Camera Clix

REEDS and RAFFIA

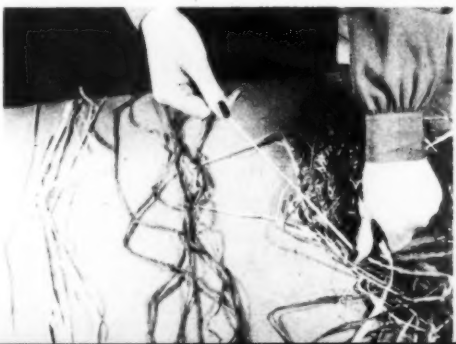
Raffia is made from the leaves of a plant growing in Madagascar. It can be woven into many useful household articles.

THE art of weaving raffia strips, made from the leaves of a tropical plant growing in the orient, into practical and decorative gadgets for the home, is one as old as the orient itself. With little skill, the amateur can construct coasters for glasses, lamps from raffia-covered bottles, bags, belts and many other items, including the handy breadbasket described here.

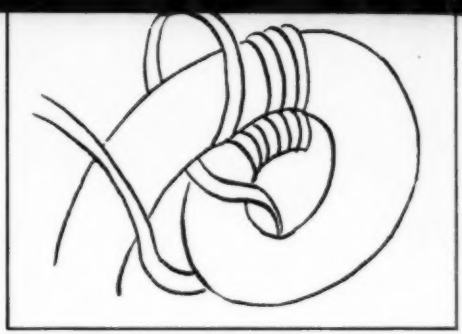


Separate strands of raffia and then soak in water, allowing them to drain on paper. Pull thickest end through needle so work can be begun with narrow end.

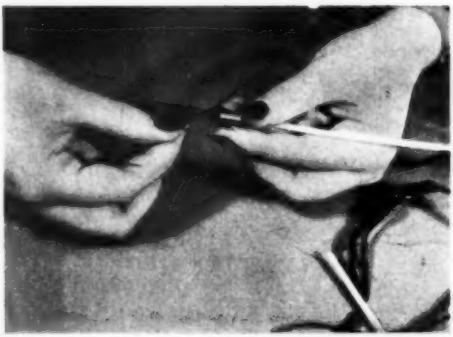
Materials: 4 reeds, 75 strands light raffia, 50 dark raffia, ruler, scissors, knife, needles and shellac. First soak the reed and taper 2" of the end (below).



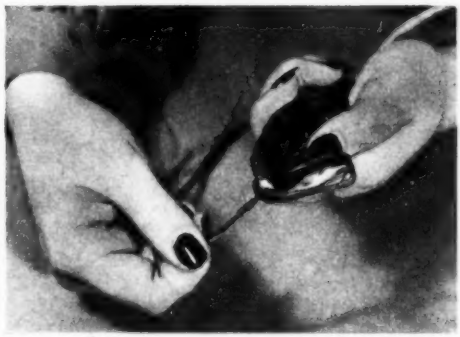
Start wrapping at the point with dark raffia. Wrap to 2½", fold and wrap the same distance along fold.



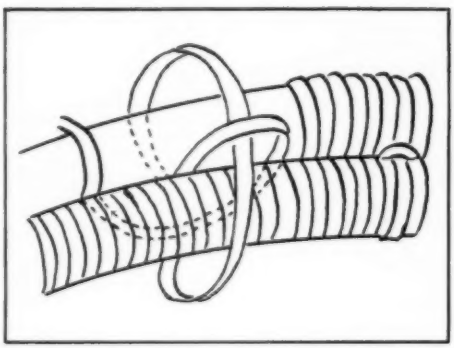
Join this folded, covered point to the reed in a curl as shown above, using a figure-8 stitch to secure.



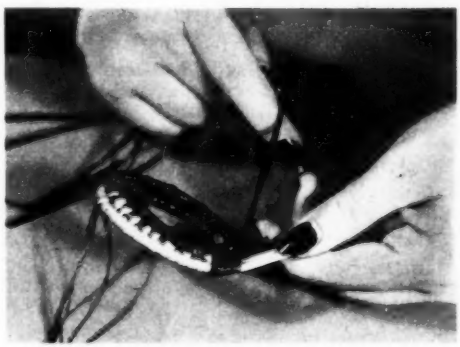
To renew a strand, place end of new piece parallel to reed so next wrapping covers old and new ends.



Continue to wrap, bending reed around center section and forming a coil which will be basket bottom.



To add a touch of design, use the mariposa stitch above. This holds coil, also. Do mariposa stitch to equal opposite side, then use light raffia again.



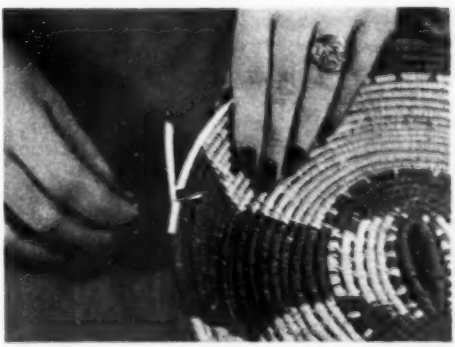
Use light raffia and figure-8 stitch to opposite side of coil. Change to dark raffia as when renewing strand. After several rows, reverse the color sequence.

To splice reeds, cut 3" slice from ends of each. When placed together, ends should be thickness of reed.

Place the tapered ends together and cover with a turn. Then continue working, covering the spliced reed.

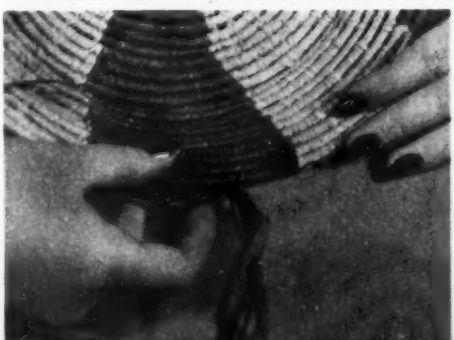
When base of basket measures 10" across, begin shaping. Allow coils to flare by spacing each row slightly.

One coil forms handles. Allow two loops in coil at opposite sides, fastening with mariposa stitch.



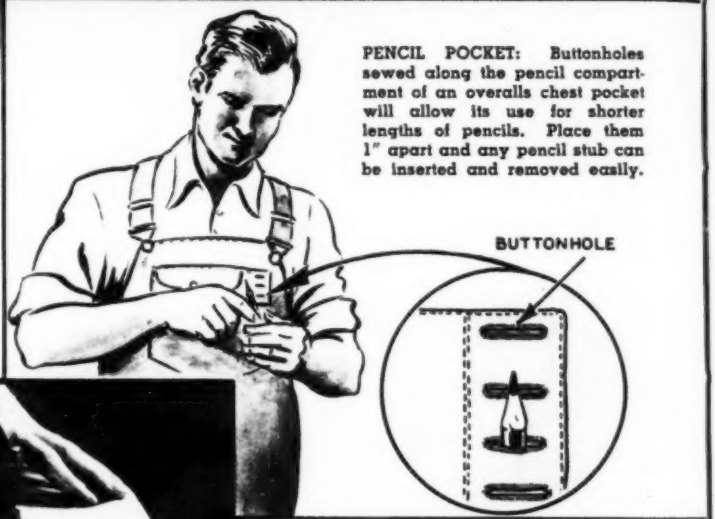
To finish reed, cut the top of end to a gradual taper so it will not be noticed. Bring end of raffia to bottom of basket and pull needle through (below).

Continue wrapping and stitching raffia over the reed end to make a continuous finish with no telltale bump. Shellac the basket (below) and let dry 24 hrs.

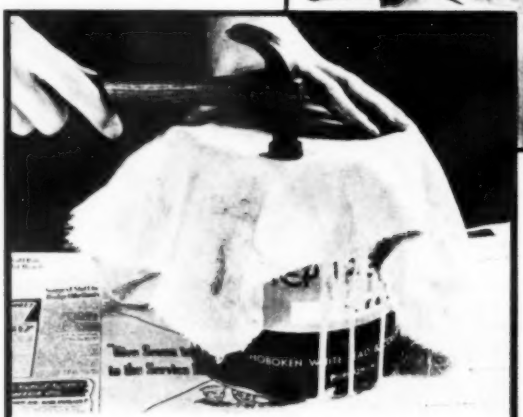


SHOP KINKS

BRUSH WIPER: Old newspapers cut into small strips and nailed to a convenient spot in your workshop, garage or tool shed as above, are excellent for wiping paint brushes, oily tools, grease-smeared fingers, etc. Paper is cheaper than rags and will not allow the paint or oil to soak through to your hands as readily. For paint brushes, fold the paper around the wet end and squeeze out the paint.



PENCIL POCKET: Buttonholes sewed along the pencil compartment of an overalls chest pocket will allow its use for shorter lengths of pencils. Place them 1" apart and any pencil stub can be inserted and removed easily.

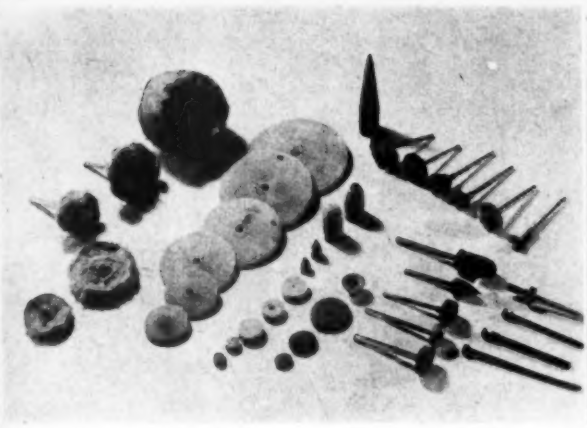


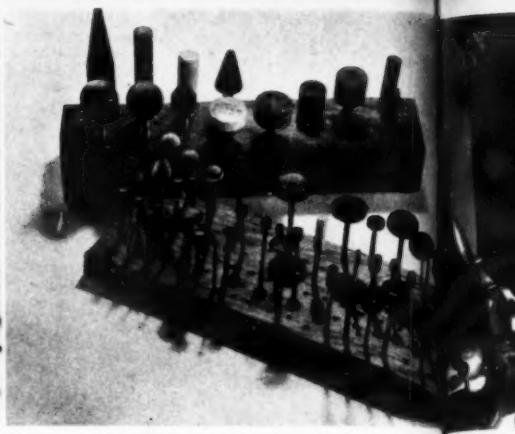
REPLACING PAINT CAN LIDS: When the lid of a can of paint is replaced, it must be hammered down if an airtight fit is desired. Sometimes the paint in the can groove will splatter when the lid is tapped. A cloth over top will protect clothes.

MARK FOR PENCIL GAUGE: It is difficult to determine by eye the proper setting of the dial gauge of a pencil sharpener for a given size pencil, but a mark filed or painted near the hole for pencils of average thickness will enable you to reset quickly.

STRAIGHTENING SPRUNG BOARDS: If a board is sprung lengthwise, it cannot by straightened by planing; special work is necessary. First sight along one side of the board and mark the hollow side at the sharpest curve. Repeat with other side and connect marks with a line. Make a saw kirf across the width 2/3 the board thickness in depth, fill it with a heavy mix of casein glue and drive in wedge-shaped hardwood strips to spread the kirf. Allow glue to soak while wedges are being made. Use as many kirfs as are necessary.

SANDPAPERING ROUND EDGES: To sandpaper the round edges of cabinet doors, table tops, etc., use a piece of cove or bed molding with sandpaper held in place by pressure of the hand.





Mounted and unmounted grinding wheels above can be had in wide variety of shapes and degrees of hardness. Unmounted ones are less expensive and can be mounted on several mandrel sizes. Large wheels are handy for shaping, smaller wheels do the finishing, cleaning.

The Gentle Job of Grinding

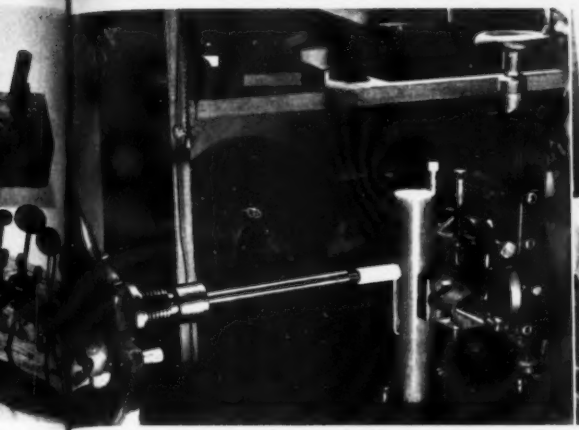
by Josephine von Miklos

THE Grinding Room of an industrial plant is very often considered the heart of the mechanical department. Grinding adds the last touch of perfection to the many tools used for production of all kinds. Elaborate machinery is used and specialists in the various phases of grinding are trained for a long time. The home workshop usually does not incorporate machines which are both very heavy and expensive, and where an occasional finishing job might require grinding, you have to rely on your ingenuity in using some parts of your regular equipment.

What we are concerned with here, of course, is not the kind of grinding which we need to sharpen our cutting or other tools. For that the regular grinding wheel is used. For the proper grinding of drills, several rather clever and not very expensive gadgets have been lately brought out, which we might discuss at a later date. But if we need to grind a slot, a hole, an edge, either straight or at an angle, a taper, etc., we can find ways to do them on our lathe and drill press with some of the attachments available for both units.

The most important fact to remember is that grinding does not mean shaping, forming, cutting in the usual sense of these words. While you can form angles, edges, radii on your grinding wheels and thereby transpose those shapes to the materials, grinding means finishing. In other words, grinding means precision. Grinding is that operation in which a couple of thousandths are vital. This is particularly true of metals. If we grind plastics, which by their nature are less able to be machined to very close tolerances, we are mostly concerned with a fine and perfectly smooth finish within the dimension best possible to obtain. In order to get these tolerances and finishes, we therefore must make sure that whatever equipment we use runs smoothly and does not chatter; that every part of our machine runs true within itself and in relationship to the other parts; and that we never attempt to hurry and try to take too much off at a time. A pretty safe bet for metal, particularly steel, is to grind off no more than two or three thousandths at one stroke. Plastics can be treated somewhat less gingerly. Ten or even twenty thousands are usually all right. That, of course, depends on the kind of plastic we use too. If, for any reason we must grind some molded part we must be quite as careful as with metals; cast plastics such as are usually used in the home shop, like Catalin, Plexiglas, Lucite, etc., can be handled more roughly since they are much softer.

Hints on metal and plastic finishing by an expert woman machinist.



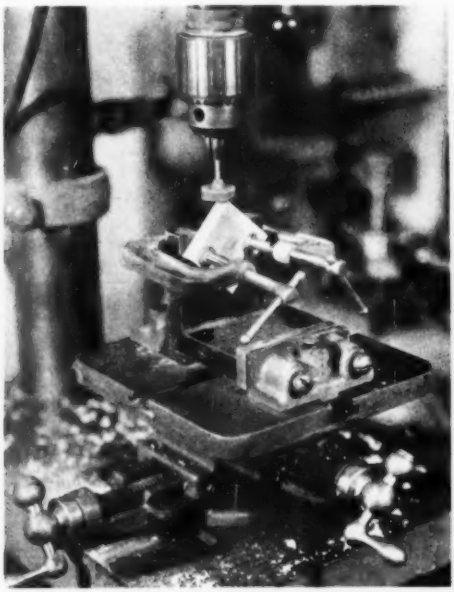
Unusual set-up above for grinding a slot in a piece of plastic, consists of extension collar to fit mounted grinding wheel that won't fit milling collar. This is handy arrangement for inside grinding on a long piece.

Buffing wheel that puts the polish on your work. Blocks of various polishing compounds are at left of wheel. Small piece is regular jewelers' rouge. Wood lathe's speed lends effectiveness to general polishing.

On the other hand, that means perhaps even more care since it is much easier to take off too much . . . and then, good-by fit!

Now, it may sound a bit surprising to find the word Polishing right after grinding. But it isn't really too far fetched to mention both of these operations in one breath if we consider that all polishing really is an even finer kind of grinding. We use buffing wheels instead of grinding wheels, and sand or garnet paper, and actually take only the most minute particles of our piece off. But if grinding means finishing, then polishing certainly does even more so. There are two kinds of polishing—with the work held against a polishing or buffing wheel, or [*Continued on page* 134]

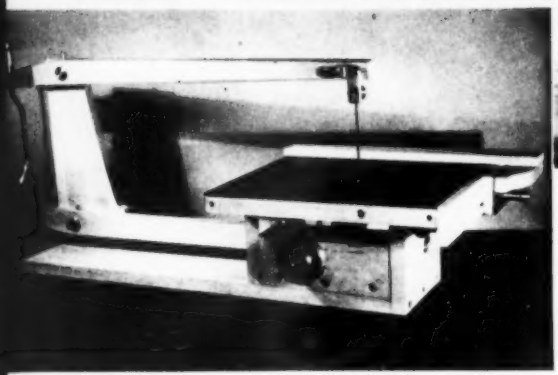
Grinding and angle across one corner of square plastic rod clamped in angle vise and milling attachment. Lack of micrometer control of vertical control makes this unsuitable for metal, but does nice plastic job.



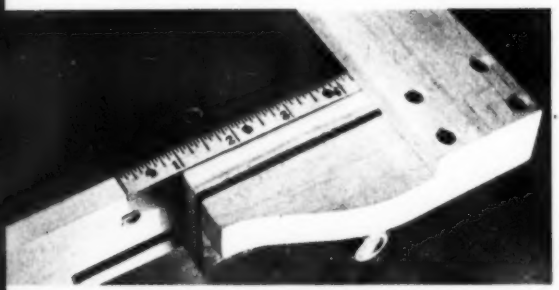
Taking corner off aluminum block with grinding wheel in drill press. Depth of cut must be gauged carefully. Use depth mike for marking depth of cut to be taken. Then use drill press handle very gently for cuts.

Home-Built

by Gordon Douglas

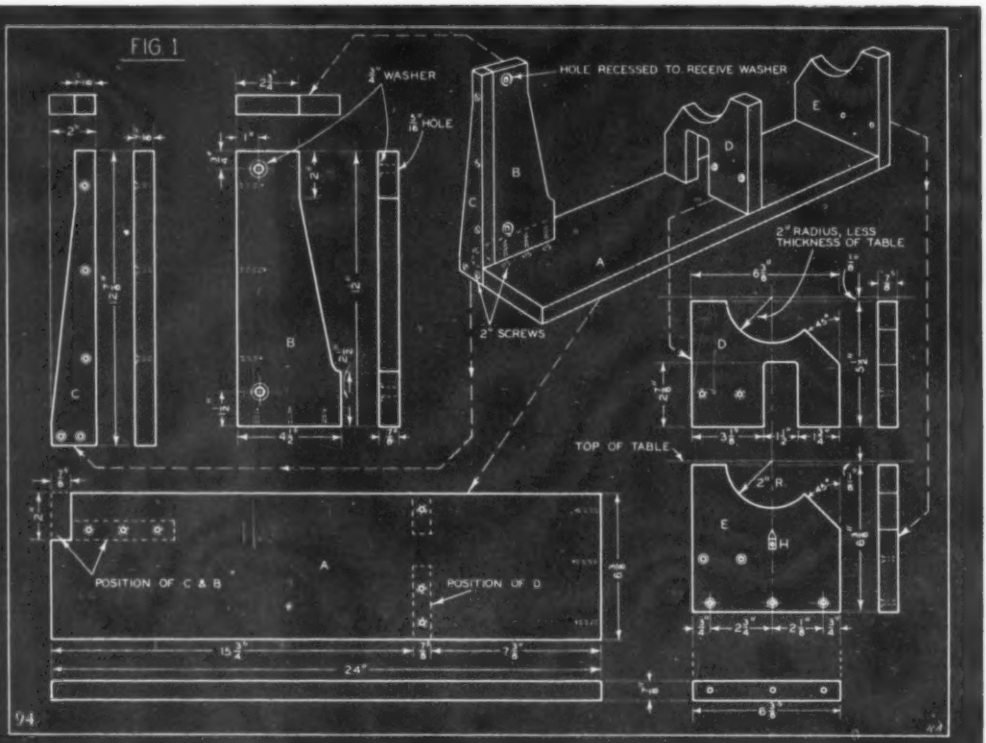


Here is the completed jigsaw; ripping fence shown below.



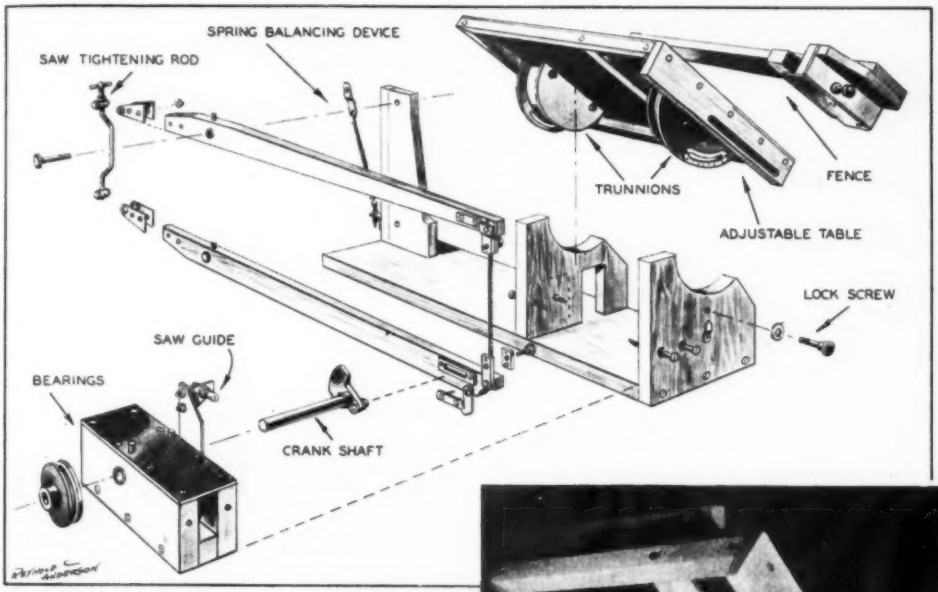
THE jigsaw shown in the accompanying photographs and drawings should be of interest to most model builders, especially those interested in the construction of model aircraft. It is fairly simple and the required materials are easily obtained, the few metal parts necessary being made from scraps picked up around the home shop.

To begin the construction the baseboard should be cut first to the dimensions given in Fig. 1. This is 24" long by 6⅜" wide and ⅞" thick. The upright part B should be cut next to the shape shown and attached to the base with three 2" wood screws inserted from beneath. Before assembling these two parts however, it would be

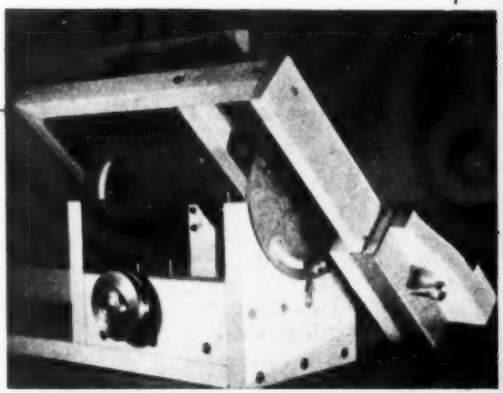


Jigsaw

A simple project which will provide you with a valuable accessory for your workshop.



The jigsaw features a tilting table. A brass pointer indicates angle of tilt on a scale as at right.

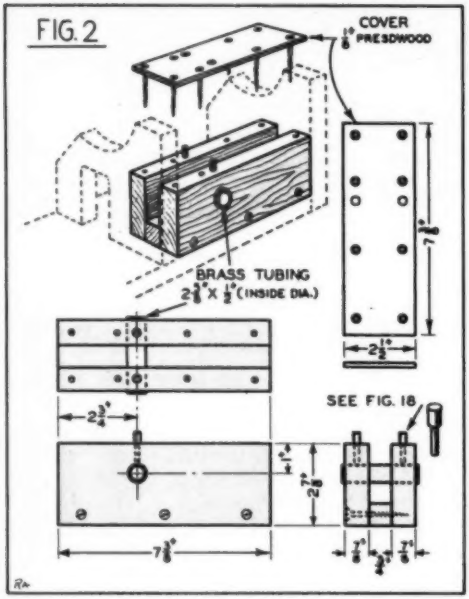


as well to drill the two $\frac{5}{16}$" holes for the saw arms; countersink them about $\frac{1}{16}$" deep with an auger bit to take a ¾" washer. These two washers should be set in flush with the surface of the wood.

The brace for the upright C can be cut and fitted as shown. Attach the lower end to the baseboard with one screw, and then square up both parts B and C vertically with the baseboard before inserting the other four 2" screws.

The two trunnion slides for the table can be considered next, and should be cut from ⅞" thick material to the dimensions given in the plan views D and E, Fig. 1. Take great care in sawing out the curves for the table trunnions, as these must fit perfectly. Also note that the thickness of the table must be cut off the radius of both curves. The front slide E is fastened to the front of the base with three 2" screws, and the rear slide is assembled on top of the base with three screws inserted from below.

The two saw arms A Figs. 3 and 4 likewise are made from ⅞" material. These arms are provided with bushings made from $\frac{5}{16}$" inside diameter brass tubing inserted in the position indicated in the drawing. The saw clamp bracket for the upper arm is cut and bent from $\frac{3}{32}$" sheet steel as at B, and is drilled ⅛" for two ¾" wood screws and $\frac{7}{32}$" for the pin on which the saw clamp rocks. The lower bracket B, Fig. 10, is made from the same material and is attached to the arm with two ¾" screws. The saw clamping assembly is shown in Fig. 10. This consists of a ¼" piece of mild steel ¾" wide and 2" long, A, and a ⅛" piece ¾" wide and 1" long, C. Both pieces are drilled, the upper hole being ⅛" to take



Crankshaft bearings are fitted with brass bushings.

the pin end of the saw blade and the hole directly underneath $\frac{3}{16}$" in the $\frac{1}{8}$" piece to clear the clamping screw, and $\frac{3}{32}$" tapped $\frac{3}{16}$"x24 in the $\frac{1}{4}$" piece. The lower hole is drilled $\frac{1}{4}$" for the pin F. This pin is turned from a short length of $\frac{1}{4}$" steel rod and is 15/16" long reduced to $\frac{7}{32}$" at one end for a distance of $\frac{1}{8}$". This pin also is supplied with a bushing $\frac{9}{16}$" long made from $\frac{5}{16}$" diameter brass tubing and inserted in the end of the saw arm as shown.

The $\frac{1}{8}$" piece C also has a short pin G riveted to it; this engages a $\frac{3}{16}$" hole drilled partly into the $\frac{1}{4}$" piece A and keeps the two parts in alignment.

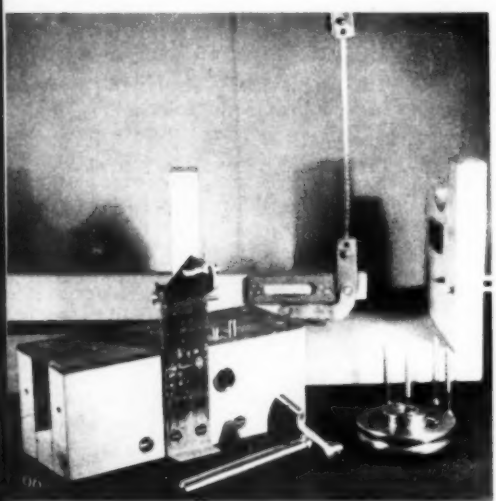
The clamp screw is turned up to its dimensions from the head end of a $\frac{3}{8}$" carriage bolt. The square neck first is turned off and the head turned to shape; the shank then is reduced to $\frac{3}{16}$" and threaded 24 threads per inch. The screw, clamp, and pin for the upper arm are made up and assembled in exactly the same way.

The two bolts for attaching the saw arms to the upright likewise are made from carriage bolts and should be a nice fit in the saw arm bushings. Full dimensions for these are given in drawing at Fig. 11.

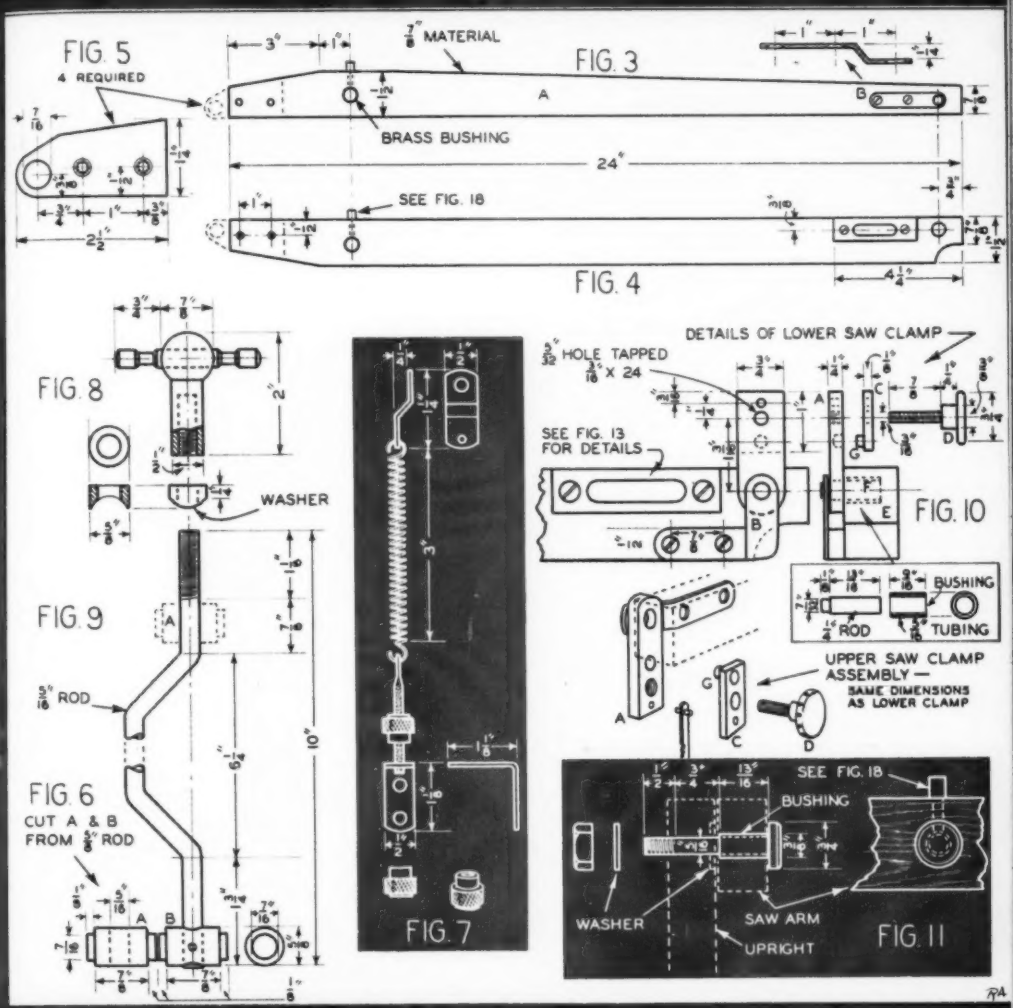
The four plates which carry the tightening rod on the rear end of the saw arms are made up from $\frac{3}{32}$" steel as in Fig. 5 and are attached to the saw arms with $\frac{3}{16}$"x1$\frac{1}{4}$" flat-headed bolts. The two trunnions which run between these plates and through which the tightening rod passes (Fig. 6) are drilled $\frac{5}{16}$" for the rod which is pinned into the lower one. The tightening screw is made up as shown in Fig. 8, the handle being turned from a piece of $\frac{5}{16}$" rod, the center portion of which should be a tight drive fit in the $\frac{9}{32}$" hole drilled in the ball end to receive it. The shank of the screw which is $\frac{1}{2}$" diameter, is drilled and tapped $\frac{5}{16}$"x18 threads per inch for a distance of about 1". This is screwed on the upper end of the rod which is threaded to fit, with a $\frac{1}{4}$" thick washer filed concave on one side placed underneath. The washer can be made from a short piece of brass tubing.

The saw-tightening rod is made from a length of $\frac{5}{16}$" rod bent as shown in Fig. 9. The reason for the bend and also for the saw clamps being offset on the side of the saw arms will be appreciated when you come to rip long pieces on the saw. With this arrangement, strips up to $\frac{7}{8}$" wide and of any length desired can be cut with ease.

The spring balancing device for the saw arms is shown in Fig. 7. The upper bracket is attached to the inner bolt on the upper saw arm, and the lower bracket is fastened to the rear of the upright brace C, Fig. 1, with two $\frac{3}{4}$" screws about 8$\frac{1}{2}$" from the top. A fairly light spring about $\frac{1}{4}$" diameter and 3" long is used, and the adjusting screw consists of a 2"x$\frac{3}{16}$" bolt, the head being cut off and the end flattened and drilled for the spring. The two lock nuts can be turned from any available material; they are drilled and tapped $\frac{3}{16}$"x24 to fit the screw.

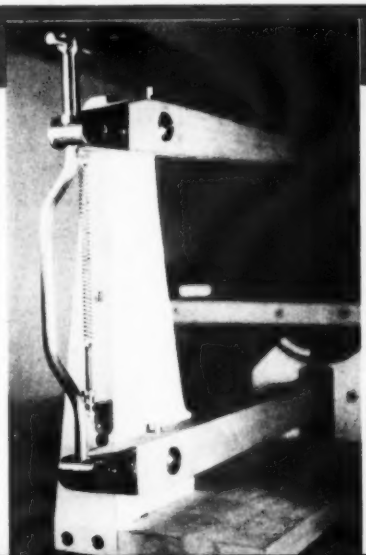


Crankshaft, pulley and bearing assembly at left.

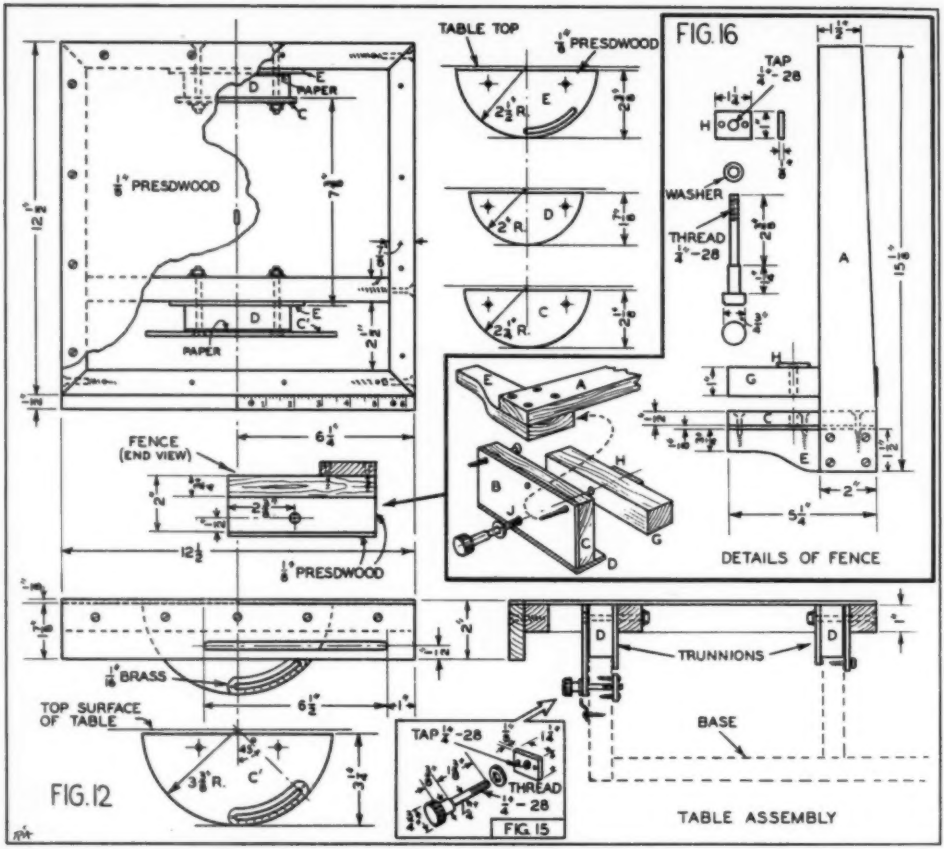


Details of saw frame, sockets, tightening rod, trunnions and spring balancing device in above diagram.

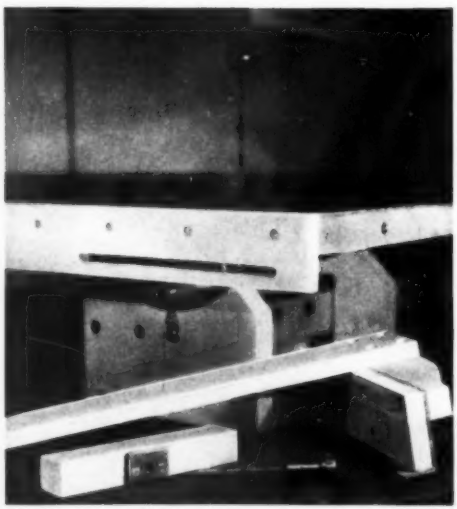
The crank slide is made up as at D, Fig. 13, from a 2¾" length of mild steel ¾" wide and ¼" thick. The slot is cut out easily by drilling a series of holes and filing out the surplus metal. Be sure to get this square and smooth as the steady running of the saw depends upon a good fit between the crank pin and slide. The completed slide is drilled and countersunk for two $\frac{3}{16}$" flat-headed bolts and is fastened to the lower saw arm in the position shown at B, Fig. 4.



Balancing device is light spring and adjusting screw.



Details of table and fence; table top is Presdwood.



Assembly of ripping fence and lock screw detail.

The crankshaft bearings are assembled as in Fig. 2, and are provided with a bushing made from a 2⅝" length of ½" inside diameter brass tubing inserted in the position shown at C. A piece of ⅛" Presdwood E, screwed on top of the bearings, keeps sawdust out of a place that is hard to clean.

The crankshaft is turned from a piece of ¾" mild steel (Fig. 13) and the crank is shaped from ¼"x2½" steel as shown at B. In fastening the crank to the shaft, the shaft hole is countersunk slightly on the outside after which a series of notches are filed around the countersink. The shaft end is turned slightly oversize and is driven tightly into the crank and riveted down into the notches. The crank pin is turned as at C, Fig. 13, and is fixed to the crank in the same manner.

The pulley used on the original saw was turned from an iron casting found in the home shop, and if you wish to make your own

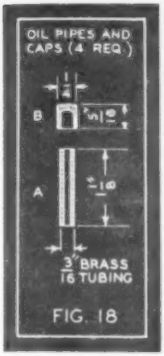
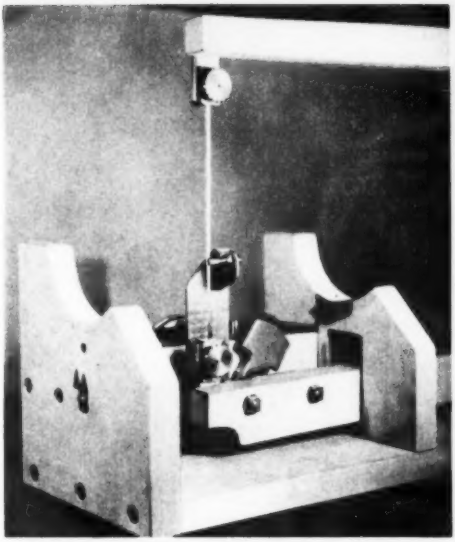


FIG. 18

and have a suitable piece of material at hand, this can be done as shown in A, Fig. 17, otherwise this part can be purchased. The original saw is driven by ¼" round leather belting which is quite satisfactory.

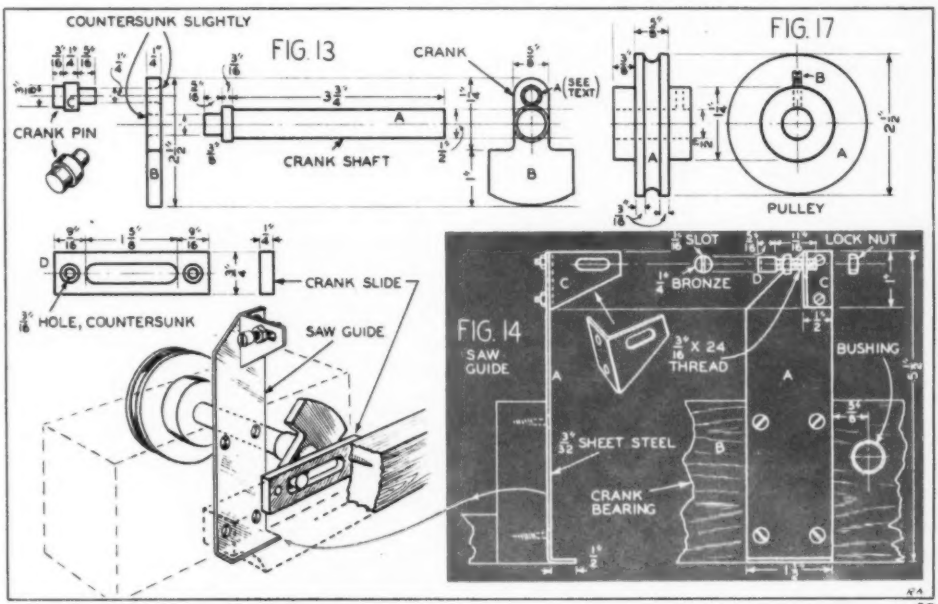
The crankshaft now can be inserted in the bearings and the pulley tightened in place. To avoid slipping, it is well to drill the crank shaft slightly to take the end of the set screw B, Fig. 17. The two saw arms also can be put in place, the lower one being inserted through the slot in the rear trunnion slide. The crank slide is placed on the crank pin and the rear end of the arm bolted to the upright. Draw these bolts up tightly enough so that the two arms lie flush against the upright without side play, but also without binding. When this has been done, assemble the tightening rod and balance spring and insert a blade in the clamps. Tighten the saw blade just enough to avoid buckling on the up stroke. Now you can adjust the spring by means of the two lock nuts until the crank will balance on either quarter.

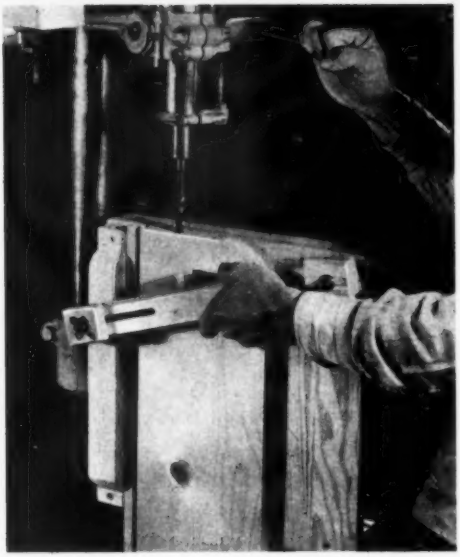
The saw guide is made up from $\frac{3}{32}$" sheet steel and a short length of bronze welding rod ¼" in diameter. The complete assembly with all dimensions is shown in Fig. 14. After the two parts A and C have been made and bolted together, they should be set in place against the inside of the bearing unit behind the saw blade and the hole for the bronze guide marked [*Continued on page* 134]



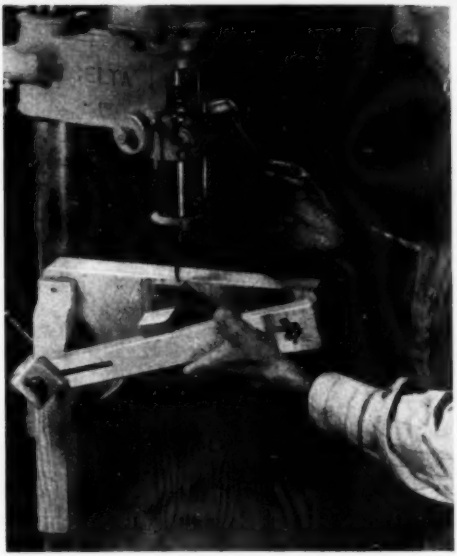
Saw guide is screw-fastened to inside of the bearing.

Crankshaft, pulley and saw guide. Chankshaft makes a force fit with crank; pulley can be made or purchased.





Use in this position for boring hole in rail end.

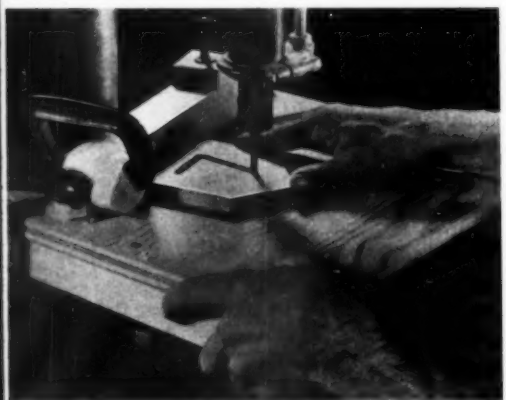


Jig can be used for boring in elliptical pieces.

Boring Dowel Holes

WITH DRILL PRESS JIG

ONE experience in setting up a drill press for boring dowel holes in rail ends, is convincing proof that a special holding device is much to be desired for such work. This versatile jig is easy to build and requires little material. If plywood is unobtainable, use solid stock, running the grain as in the drawings. Use ¼" carriage bolts of necessary lengths. The dimensions noted are for a drill press table 10" wide, and can be modified according to the machine. The jig consists of a base bolted to the drill press table, a carriage sliding on it, an adjustable fence and hold-down bar, and a pressure block.



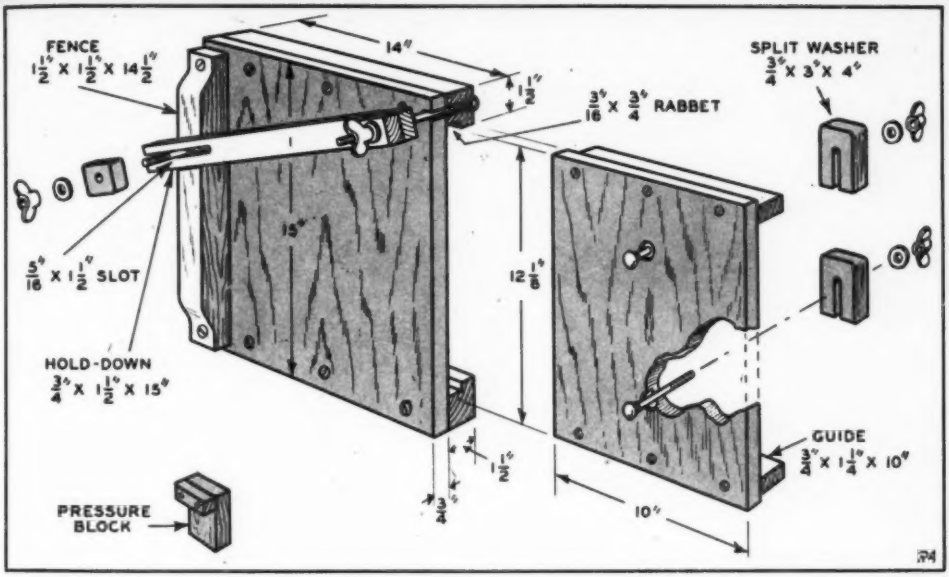
Setup for use horizontally. Note stop block on fence.

The base is attached quickly to the table by passing the wing nuts and iron washers (permanently screwed on the bolts) through the table slots. Slip the wooden split washers over the bolts between the iron washers and the underside of the table and tighten the wing nuts. With some machines, a second set of wooden washers is required to shim the base out from the table, permitting the carriage to clear the drill press column.

Square the base stock, drill and countersink the screw holes, and bore the bolt holes. Screw on one guide cleat and bolt the base in place with the cleat tight against one table edge; then attach the other cleat. Assemble the carriage on the base in a similar manner, using paper between the plywood and slide, if necessary, to give sliding clearance. Wax the slides.

The fence carries a bolt 5" from the upper end. Screw it at the left of the carriage at right angles to the upper edge. Then remove the lower screw, swing the fence to an angle of 45°, and turn in the screw. Do this for other angles as they are needed in use.

The hold-down has wooden washers which



Make of plywood or solid stock. Alter dimensions indicated above to fit those of your drill press table.

are removed when thick stock is clamped for boring. A piece of coarse sandpaper glued to the inner face improves the grip on the work.

The photographs suggest uses of this jig. To bore holes in rail ends, swivel the drill press table to a vertical position and attach the jig. Insert a bit in the chuck and swing the table sidewise until the bit is centered at the proper distance from the face of the carriage. Mark the positions of the holes to be bored on the rail ends. Clamp the rail with the face side to the jig and one edge against the fence, and slide the carriage until the bit centers on the mark. Set the depth gauge and bore the hole. Then slide the carriage to the next line, bore the second hole, and so on. To bore the other end, place the opposite edge against the fence with the face side against the jig. If the edges are not parallel, bore corresponding ends of all rails, then swing the fence to the required angle, clamp the lower end, and proceed as before. In many cases, readjustment of the fence can be dispensed with; simply align the end of the rail with the top of the jig.

A similar setup is used for boring dowel holes in the ends of circular or elliptical segments of picture or mirror frames. The ends are aligned with the jig upper edge. Incidentally, a router bit often is better for this work than a boring bit since it has no center point to slip off hard grain, starting the hole off-center.

A third setup is for boring dowel holes or routing for blind slip tongues in the ends of hopper sides. Here the fence is swung to bring the slanting end of the rail horizontal, and the drill press table is tilted to fit the bevel. Sidewise swinging of the table positions the router bit relative to the thickness of the material. Take [*Continued on page* 138]

Using jig to rout end of hopper side for slip tongue.

THE SCHOOL SHOP

Conducted by Gilbert Paust

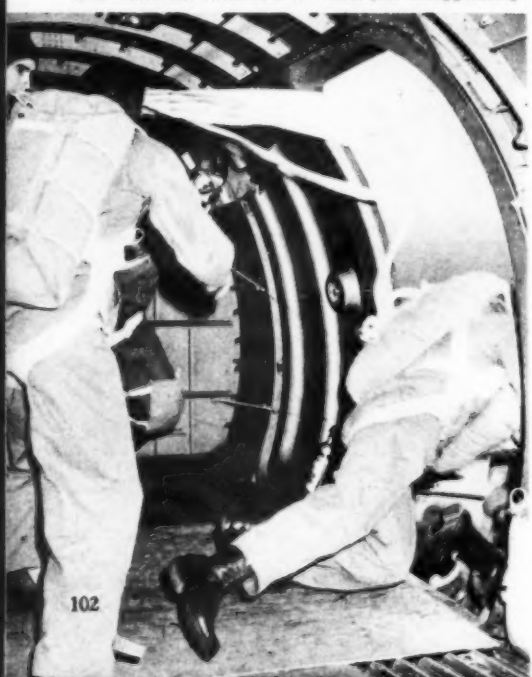
Lieutenant, Civil Air Patrol, Westchester Squadron

Chapter 19: Hitting the Silk

EVER hear of the Caterpillar Club? It's not a society of entomologists whose members spend their lives collecting species of caterpillars; it's a fraternity of pilots with a world-wide following. And not everyone can become a member, for the single qualification for membership is one which only fate can give you. If, in your flying experience, you have occasion to bail out of your plane to save your life, you automatically qualify for admission. How did the club gets its name? One of the materials which has played a prominent part in parachute construction is silk, and so the lowly silkworm is the caterpillar honored by the name, even though nylon and cellulose are proving superior in many respects to the natural product.

The chute is one of the most indispensable pieces of an aviator's equipment. He may never have to use it, it is true, but you'll agree that it's a handy thing to have around in case of emergency. The C.A.A. requires parachutes only during acrobatic flight, but it's a good idea to carry one along on all trips—just in case. Let's familiarize ourselves with the various types so we can appreciate them fully and know how to use them should the occasion arise.

A static line in the transport pulls open the chutes of these Marine paratroopers as they bail out head-first. Note the boots of No. 1 man just disappearing.



Leonardo da Vinci invented the first helicopter, and we must give him credit for designing the first parachute, too. Our modern ones, of course, are far more complex and efficient than the simple, umbrella type of his creation, but he gave us the idea, nevertheless.

Our chutes are of three main types: seat, back and lap; they are named according to the position they occupy on the wearer's body. A seat pack acts as a cushion for the pilot when he is seated in his plane, but makes it difficult for him to get up and move around should he desire to do so. The back pack enables him to move about, but is very uncomfortable in a sitting position. A lap pack, used a great deal by the plane gunners, enables them to shift their positions in their seats without hindrance. A fourth type, the chest pack, is used only as an auxiliary chute for exhibition and training jumps. Chute sizes refer to their diameters when open. The auxiliary pack is the smallest with a 22-ft. diameter; back and lap packs are 24 ft.; seat packs may be either 24 ft. or 28 ft.

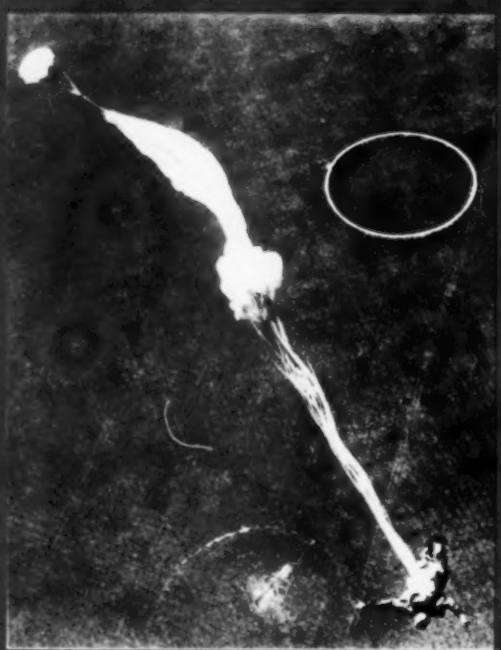
The complete assembly of the chute consists of three units: the canopy, the pack cover and the harness.

The canopy is the large, umbrella-like top which catches the air during descent. It is made of silk, pongee or nylon. Like an umbrella, the canopy is composed of panels, and corresponding to the umbrella ribs and separating the panels are suspension lines or cords, each one of which runs in a continuous piece from the pilot's harness up over the canopy and down the other side back to the opposite side of the harness. At the apex or

Here he comes, with the huge, white canopy billowing out above him. He can change direction of descent by slideslipping. To avoid an unpleasant cross-country trip along the ground, air must be spilled from chute quickly by pulling on bottom shroud lines.

Harness resembles a swing. Main lift web passes under body; chest and leg straps hold it in place.

When ripcord is pulled, pack opens and pilot chute is released, catching air and drawing out canopy.



top of the canopy is a vent or opening edged with elastic cord. When the chute is opened while descending at high speed and suddenly catches the air, this vent stretches and allows some of the air to escape through, thus relieving the excessive pressure and eliminating some of the sharp jerk felt by the pilot.

To help pull out the main canopy when the chute is opened, a small canopy about 3 ft. in diameter, called a *pilot* or *pop* chute, is attached to the apex of the canopy. It is constructed like the canopy except that it has spring ribs almost exactly like those of the common umbrella. When the chute is opened, the ribs open this pilot chute, it pops out, grabs the air stream and pulls the main canopy with it.

The pack is the linen case in which are carefully arranged the canopy, lines and pilot chute. Packing the canopy is an art and must be done with great care. Every Army and Navy pilot is taught the procedure, but chutes for civilian use must be packed only by a C.A.A.-licensed Aircraft and Engine Mechanic with a Parachute Rigger's Rating. Special tools and technique are required. The canopy and lines are stretched out on a long table provided for the purpose. The lines are folded carefully and tucked into loops fastened to the bottom of the pack. As this tucking process progresses, the canopy is drawn gradually along the table to the pack and is folded and arranged last. The bottom of the pack is semi-rigid, being reinforced with wire. The sides and ends of the pack fold over the chute and to them, extending around the outside of the pack, are attached the pack-opening elastics which pull back the flaps when the chute is opened. The pop-chute usually is placed beneath two separate flaps under the end flaps of the pack in a sort of separate compartment. This arrangement allows it to spring out first.

One of the end flaps carries two cones with small holes through them; these fit through two grommets or holes in the other end flap. Through the holes in the cones are inserted the two small prongs of the ripcord. When the ripcord is pulled, these two prongs pull out of the cones, the cones pull through the grommets, and the pack-opening elastics spread the flaps, releasing the pop-chute and canopy.

The ripcord is a piece of 3/32-inch flexible steel cable, varying in length with the type of chute employed. On one end is a

grip or handle and on the other end are the two prongs previously mentioned. The ripcord passes through a flexible housing attached to the harness in such a manner that the ripcord handle is within easy reach, usually on the left chest. This housing protects the ripcord against accidental release. Should you ever have to use your chute, here's one little item to remember. While floating earthward, you'll find that you'll have the ripcord dangling in your hand. Hang on to it and don't throw it away! A replacement will cost you a tidy sum.

The harness is made of three-ply linen webbing. The principal part is the main lift web, arranged to form a cradle or swing in which you sit as you ride down. The suspension lines are attached to its upper ends. The purpose of the rest of the harness is simply to keep you from slipping out and consists of arm loops and leg loops with an additional band across the chest. See photo at top of page. The chest band and leg bands are equipped with snap buckles and D rings.

Here are some general rules for handling your chute. If you're wearing it, release the leg straps and let it dangle behind you, or let it hang in its natural position; don't pick it up and help it along with one hand. When it's off, the best way to carry it is in the bag supplied for that purpose. The next best thing is to fold the harness neatly and carry the [*Continued on page* 136]

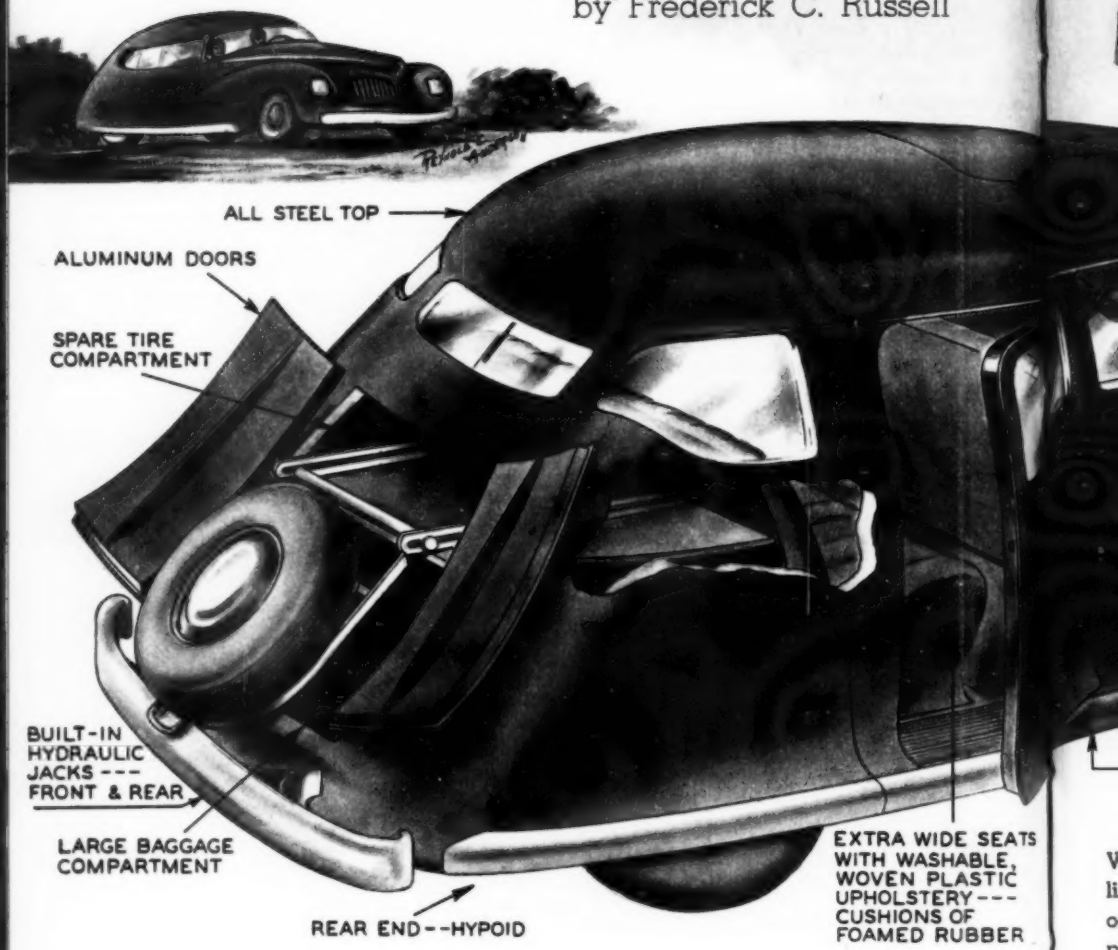
In packing, chute is spread out on a long table. Shroud lines are folded and tucked in loops in pack.

Then the canopy is folded carefully on top of the shroud lines. Pilot chute has a wire spreader to open it and is packed last under flap.

Small, metal cones at end of one flap pass through grommets in opposite flap. Prongs on ripcord, inserted through cones, hold pack together.

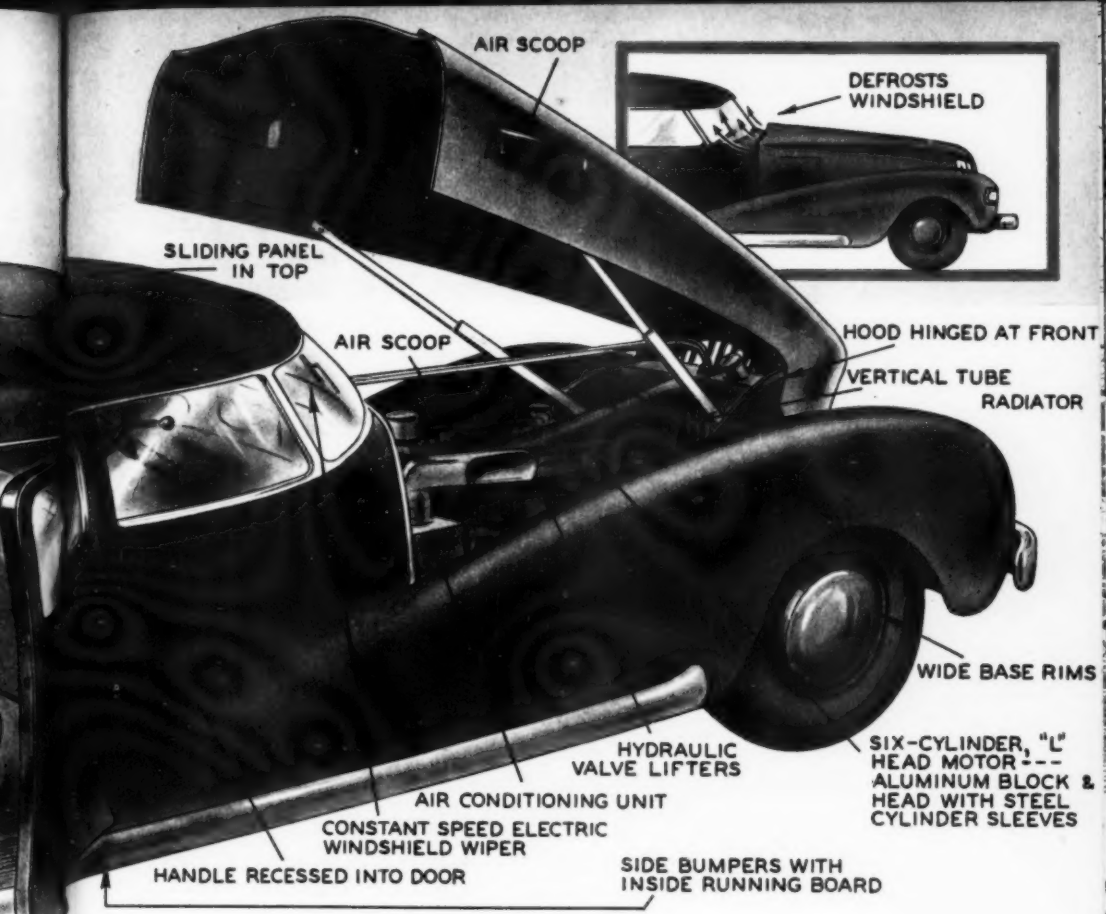
Practical POST WAR CAR

by Frederick C. Russell


ALL STEEL TOP
ALUMINUM DOORS
SPARE TIRE COMPARTMENT
BUILT-IN HYDRAULIC JACKS --- FRONT & REAR
LARGE BAGGAGE COMPARTMENT
REAR END--HYPOID
EXTRA WIDE SEATS WITH WASHABLE, WOVEN PLASTIC UPHOLSTERY --- CUSHIONS OF FOAMED RUBBER

ONE of these days Detroit may get us all hot and bothered about a rear-engined car with a transparent top and soy bean body; but right after the war most motorists will settle for something experience has demonstrated can serve admirably in helping them rediscover America by automobile. It need not be just a 1942 job with frills. Nothing so old-fashioned. They're looking for a car that is a tempting yet practical mixture of many of the best features which some car owners are now enjoying, with a few innovations tossed in for good measure.

I believe the car should carry a six-cylinder engine because this gives better performance than a four but with less expense and fewer parts than are required for an eight. Sixes also are inherently balanced. For simplicity it would be an L-head, and to eliminate need for fussing with tappets it would have hydraulic valve lifters which keep clearances at zero regardless of motor temperature. Thus I would continue to enjoy the safety of low center of gravity without the current difficulty of getting at the valve compartment. For convenience in servicing this job the radiator would be placed well ahead of the engine and the firewall well back of it.


AIR SCOOP
DEFROSTS WINDSHIELD
SLIDING PANEL IN TOP
AIR SCOOP
HOOD HINGED AT FRONT
VERTICAL TUBE RADIATOR
WIDE BASE RIMS
HYDRAULIC VALVE LIFTERS
SIX-CYLINDER, "L" HEAD MOTOR--- ALUMINUM BLOCK & HEAD WITH STEEL CYLINDER SLEEVES
AIR CONDITIONING UNIT
CONSTANT SPEED ELECTRIC WINDSHIELD WIPER
HANDLE RECESSED INTO DOOR
SIDE BUMPERS WITH INSIDE RUNNING BOARD

What an automobile expert believes millions of postwar motorists may really be offered in the way of a practical, medium priced car of thoroughly advanced design.

Wheelbase of this car would be not less than 120 inches, preferably more. History has shown that proponents of short wheelbase have invariably been forced to adopt longer wheelbase for roominess and comfort. Also there is no use sacrificing comfort for the slight advantage of a little extra convenience in street parking, which underground parking will rapidly supercede anyway. Weight should be around 3400 pounds. With speeds going upwards again after the war the advantage in the safety of a sturdy car will be an important consideration. Chief engineer of one of the [*Continued on page* 132]

THIS MAY BE YOUR POSTWAR CAR

MOTOR:
Six cylinder, L-head.
90 horsepower at 3200 rpm.
CLUTCH:
Improved fluid.
TRANSMISSION:
Three forward speeds, synchromesh.
High second gear for speedy traffic use.
REAR END:
Hypoid.
BRAKES:
Four-wheel electric. Manual brake on propellor shaft.
MOTOR FEATURES:
Aluminum head and block using steel sleeves.
Radiator shutters.
Closed cooling system with permanent anti-freeze coolant.
Water pump shaft driven so that both fan and pump won't fail at the same time.
Single downdraft carburetor with automatic choke.
CHASSIS AND BODY FEATURES:
Flush door locks with recessed door handles.
Constant speed electric windshield wipers.
Wheelbase 120" or over.
Weight 3400 pounds.
Sunshine sliding panel in roof.

Various forms from which molds can be made (left). Freshly cast pieces (right).

The Potter's Art

by R. H. Jenkins

This is the final installment of a series of articles on pottery making which began in July MI. It covers firing and decorating pottery, mold making and casting.

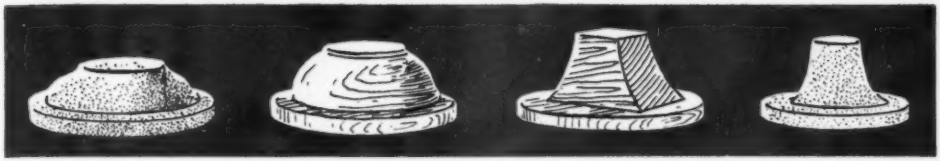
PART III

FIRING: If a pottery kiln is within easy reach, arrangements usually can be made to have the pieces fired and glazed. If there is no kiln available, however, there is still the open fire process. The problem in firing pottery is to have a gradual rise of heat reaching a peak and then a slow, even cooling period. The modern kiln is nicely adapted to such conditions, so that the problem is to meet, in some manner, a like situation. An open fire cannot be controlled easily, but the protection of the pottery can. By burying the pieces in dry sand or dirt, either in the ground or in a strong container, something of the protected conditions are produced. Thus bury your pieces in dry sand or dry dirt in a strong old can or iron kettle. This will protect the pottery from the sudden fluctuations of the fire around the container. Fire for five or six hours and let cool until everything is cold. Brush off the ashes, and the pieces are ready for the decorations.

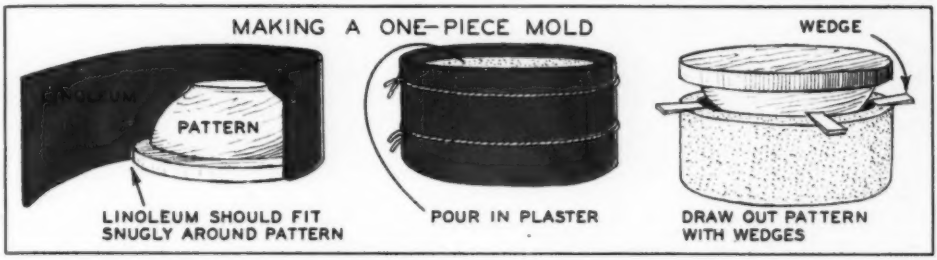
Pouring the slip into the mold for clay casting.

Should you decide to construct an outdoor kiln, be absolutely sure that no direct heat is allowed to contact the pieces. This would cause uneven expansion and contraction of the clay and result in structural defects and cracking. If all your pieces are small, they can be buried in a can of sand and fired in the firebox of a stove.

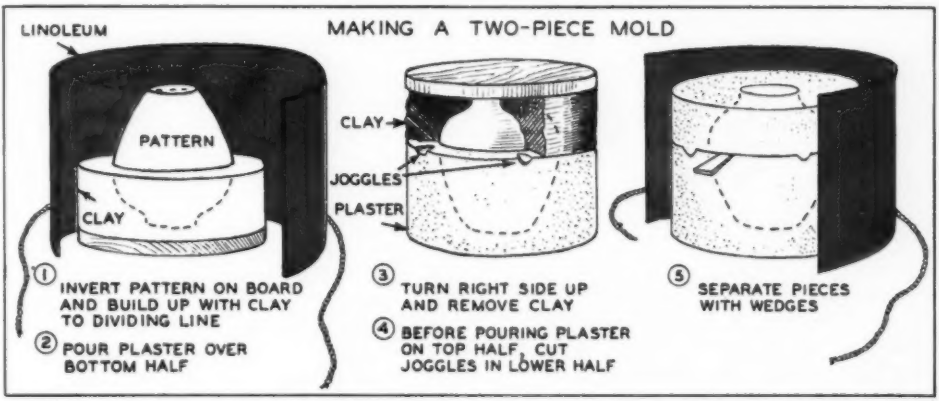
Decorating: When the pieces have been made dust free, they are ready for decorating. Though glazing is not practical in the open fire process, there are still many possibilities. The pottery may be sized and enameled with a



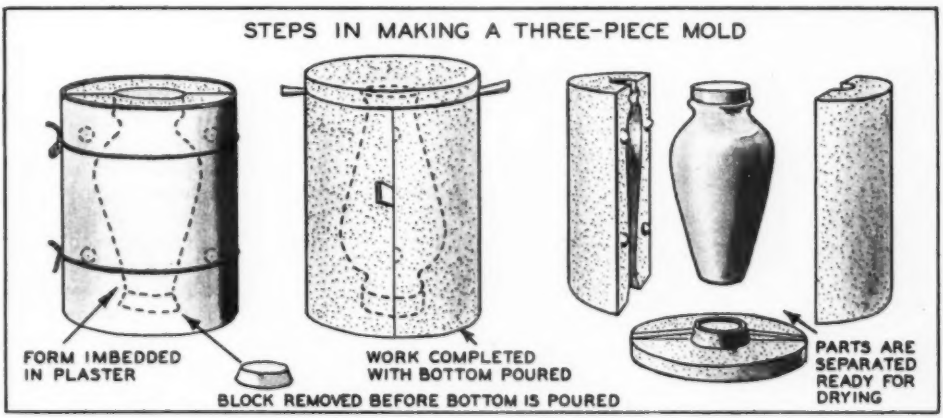
Here are some forms for one-piece mold. If made of wood, the form is fastened to a board with a screw.



For one-piece mold, tie linoleum in place and pour plaster. If clay pattern is used, dig clay out of mold.


MAKING A TWO-PIECE MOLD
LINOLEUM
PATTERN
CLAY
1 INVERT PATTERN ON BOARD AND BUILD UP WITH CLAY TO DIVIDING LINE
2 POUR PLASTER OVER BOTTOM HALF
CLAY
JOGGLES
PLASTER
3 TURN RIGHT SIDE UP AND REMOVE CLAY
4 BEFORE POURING PLASTER ON TOP HALF, CUT JOGGLES IN LOWER HALF
5 SEPARATE PIECES WITH WEDGES

Steps in making a two-piece mold. Note depressions or joggles in lower mold to keep halves lined up.


STEPS IN MAKING A THREE-PIECE MOLD
FORM IMBEDDED IN PLASTER
WORK COMPLETED WITH BOTTOM POURED
BLOCK REMOVED BEFORE BOTTOM IS POURED
PARTS ARE SEPARATED READY FOR DRYING

Three-piece mold is similar to two-piece type. A strong case knife can be used instead of wedges to open.

Firing pottery packed in sand and earth in a metal container which is set in center of campfire.

good grade of enamel. It can be dipped in "water spar" which is sold by the paint companies for the purpose of odd decoration. Water spar will float on the surface of water; mixed with several colors it forms many strange designs. If a piece of pottery is dipped into the mixture, paint will cling to the surface of the piece, producing very interesting effects. The pieces should be sized before the dipping is done.

Then there is the Indian and Mexican decorating which is always interesting. This can be done with water color and opens a field all by itself in design.

For insuring against leaking, the writer recommends the use of hot paraffin. Paraffin is good for both glazed and unglazed pottery. Heat it until it is smoking hot, and warm the piece to be treated, also. Rub it thoroughly on the inside of the piece while the latter is still warm; and the problem is solved.

Fig. A is a two-piece mold pattern; Fig. B requires three pieces; Fig. C needs three or four sections.

Commercial Possibilities: There is a nice field for anyone desiring to make some convenient spending money by making novelties. A lot of these do not have to be glazed, but can be decorated with brightly colored paints. Little dolls, dogs, flower inserts and animals of all sorts are possible. The insert is simple to make. It is pressed from a mold and the holes pierced with a small ½" tube. They are easily fired and bring a good price.

Mold Making: For casting, molds must be made. These molds are built with plaster of Paris, or casting plaster, which is the same product only more finely prepared for the purpose. The plaster can be purchased through any local dealer in building materials.

The first step in mold making is the production of a form around which the mold is to be made. This is called the pattern, and can be developed in various ways. A shape modeled from clay is one possibility, an old piece of pottery is another, a wooden form turned on the lathe is another, or a block of plaster, cast and turned, offers still another choice. In the factory where great finish and accuracy is needed, the last method is preferred. For our purpose, however, the clay-modeled piece or the wooden block turned will serve nicely and is made more easily.

Molds are classified by the number of parts, such as a one-piece mold, two-piece mold, etc., the number of parts being controlled by the sections necessary to take the product from the mold. The illustration of suggested shapes will show what is meant. To begin with, it is well to make a one-piece mold as it offers as few problems as possible. Build of clay a shape as in the illustration, or turn on a lathe a like form of wood. Leave at the top of the pattern a good half inch for spare or turning so that when the rough edge is cut off, the piece will be the correct height. Make the pattern larger around than the finished pieces, too, so as to allow for shrinkage. Ordinarily clay shrinks from 1½" to 2" per foot, and this has to be taken into consideration when making a piece of a definite size.

Place the clay model upside down in the center of a circular board which should be at least 3" larger in diameter than the diameter of the pattern. Tie a piece of linoleum around the board with the linoleum extending 2" above the top of the clay pattern. Fill any crack around the board with clay so that the plaster will not run out. To mix the plaster, place the water in a container and add plaster at the [*Continued on page* 138]

Landscape Architecture

DO IT YOURSELF AND SAVE MONEY

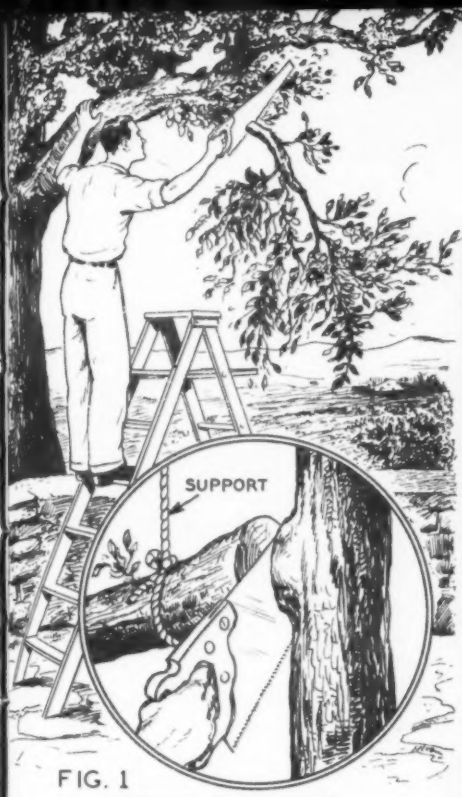


FIG. 1

View hidden by lower part of tree may be revealed by removing some low-hanging foliage.

Prune small shoots cleanly and close to trunk. Paint large cuts for protection.

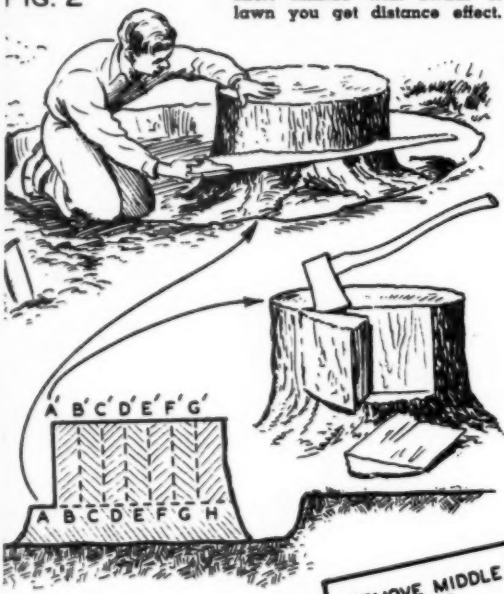
by J. Modroch

UNLESS controlled by judicious pruning or felling, foreground trees and bushes can rob a homesite of its most valuable assets—dramatic views and distant vistas. Here are plans showing how a "curtain of foliage" may be raised, parted or drawn back to present background beauty from your windows and terrace, and practical directions for achieving expert results.

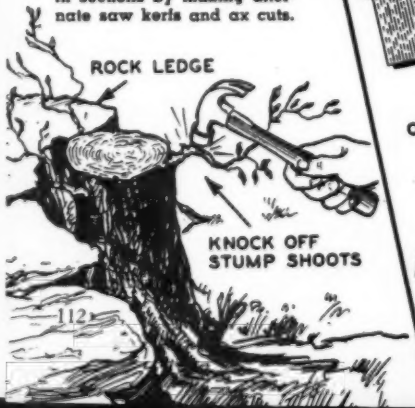
You can prevent foliage on the low-hanging branches of shade trees from curtaining off distant views by removing the branches or their bottom shoots as shown in Fig. 1. Use a pair of snips on small shoots and a coarse-toothed saw on larger branches. Make your cuts clean and keep them as close as you can to the main branch to avoid leaving stubs. In cutting off heavy limbs, support them

FIG. 2

By parting dense growth on short hillside with swath of lawn you get distance effect.

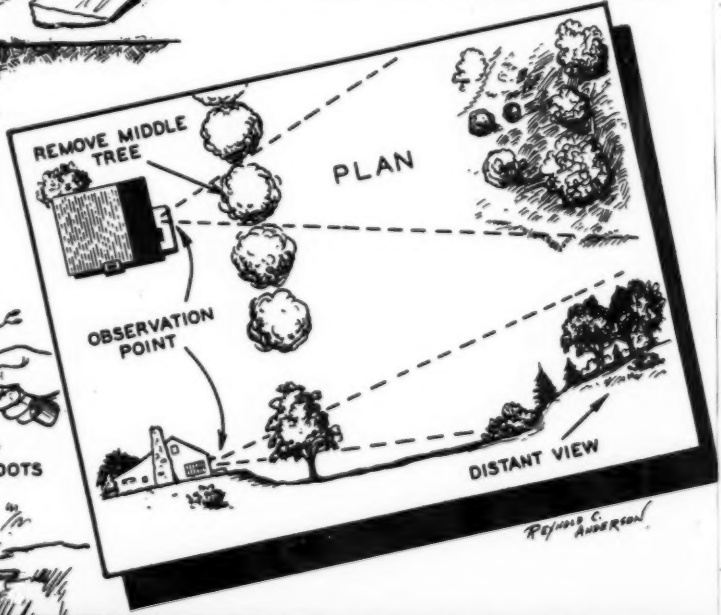


To cut off large stump without jamming saw, split it off in sections by making alternate saw kerfs and ax cuts.



with a prop or with a rope tied to an upper branch. This will prevent the limb from stripping the bark from the trunk if it falls before the cut is finished. To protect the new wood exposed by the cut and to color it to match the bark, give it a coat of dark gray paint. Bark will eventually grow over the cut. It will not be necessary to paint over cuts made on resinous trees, such as pines, as the resin that exudes from the cuts will seal them and soon darken down with exposure to the air. Plan to prune maple trees in the late summer or early fall when the sap is not flowing. Otherwise, the rush of sap from the cuts is likely to wash away the paint before it has a chance to set.

Where a good view is blocked by a solid row of dense trees or high bushes, take out one or more of them to part the foliage, thus creating a vista, or avenue of sight. See



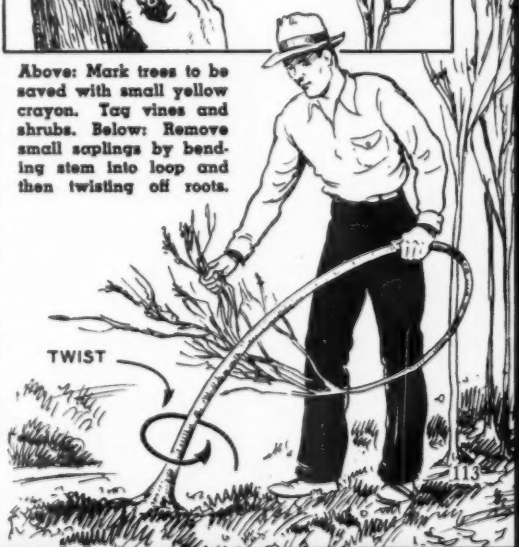
In some cases high growth should be removed back to strong focal point on lawn.

To take out large saplings and small trees sever side roots (A) then bend tree down and cut heart root (B). In stony soil use long-handled cutter instead of hatchet for cuts.

FIG. 3

Fig. 2. Large trees should be felled so that their fall will not damage buildings and other trees. Chop or saw the trunk of a tree that stands perfectly upright from the side toward which you wish the tree to fall. Trees that lean to one side can be pulled over in the right direction with the aid of a rope.

After felling a tree, cut the stump off below ground level, as shown in the drawing or, if this is not feasible, cut it off flush with the ground. If left exposed above ground, the stumps of some trees, such as ash, are hard to kill and will continue to sprout new shoots. Of course, stumps may also be removed by uprooting them with a stump puller, provided firm anchorage can be found for the puller. Another stump or a tree larger than the stump to be pulled may be used for this purpose. If you use a tree for anchorage, be sure to put plenty of padding under the anchor chain to avoid damaging the bark. Where a stump cannot be uprooted or cut off, due to interference by a rock ledge or other obstacle, don't sever its shoots with a clean cutting tool, such as a pair of clippers, an ax or a saw.



Above: Mark trees to be saved with small yellow crayon. Tag vines and shrubs. Below: Remove small saplings by bending stem into loop and then twisting off roots.

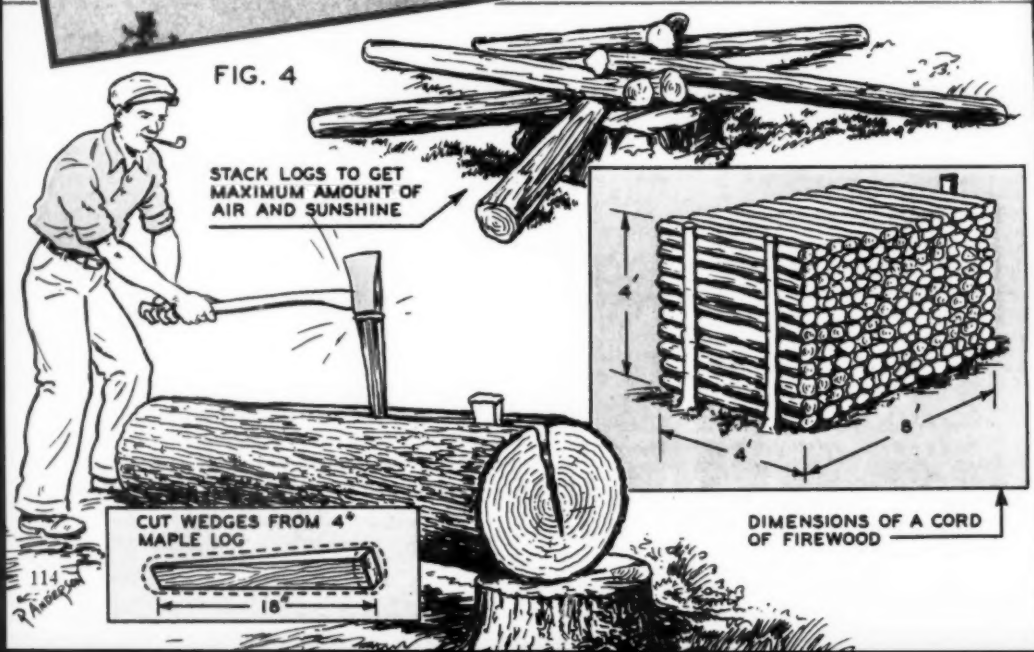
Instead, knock them off with a hammer. This treatment fractures the sprouting joints and discourages further growth. Bushes and other thin-stalked growth can be cut down quickly with a pair of long-handled cutters.

A pleasing effect of depth and distance has been created on the short, dense hillside shown in the pool photograph by cutting a gently turning swath up through the trees and shrubbery and cultivating the cleared portion to lawn. Treating the slope in this manner has also set off the pool effectively by giving it foreground prominence in the landscaped area.

Nothing seems to grow faster and denser than a stand of saplings flanking a home and garden. With every summer's growth, it becomes a higher wall that threatens to cut off more and more of the distant viewpoints which go to round out the

Top: Plot being cleared of unwanted growth after items to be saved had been marked. Paths, cleared first, simplified job. Left: Same plot cleared. Young fruit trees have been planted as start of eventual orchard.

FIG. 4



perfect setting for the homesite. To relieve this hemmed-in effect it is best, in some cases, to clear out the entire stand back to a strong focal point. The large maple jutting from the split rock and the stone wall bordered by evergreens shown in the photographs in Fig. 3 are examples of such strong focal points. In other cases it may be advisable to save some of the trees, along with valuable bushes and vines that might be growing among them. Trees to be saved should be marked with a soft yellow lumber crayon; shrubbery and vines with white tags. If the plot to be checked is densely wooded you may find it expedient to open it up a bit by cutting a path through it before proceeding with marking and tagging.

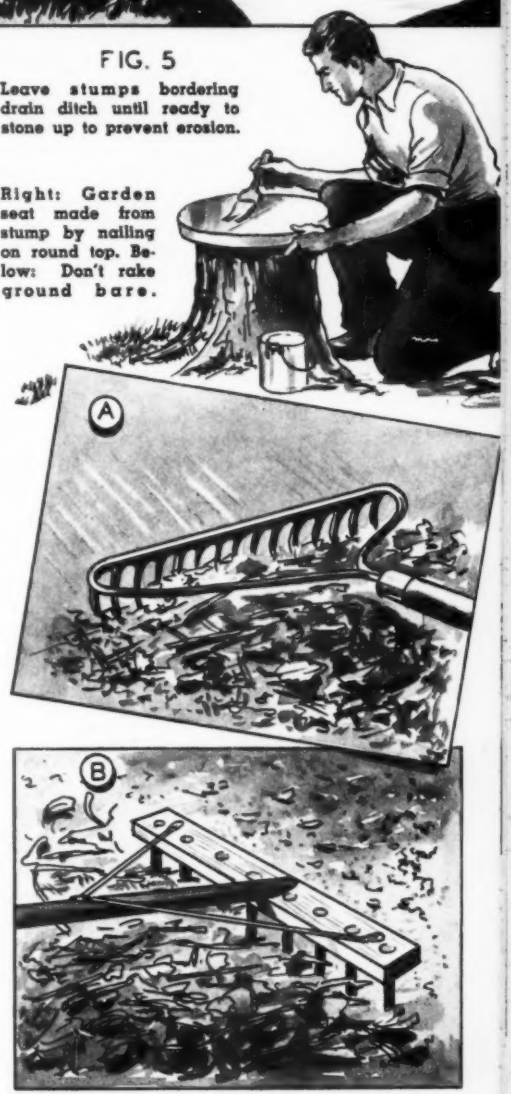
The best time to uproot a thicket of saplings is in the early spring when the ground is soft. Those up to 1" in diameter can usually be uprooted by looping and twisting them as shown in the drawing. To remove larger ones, dig away the soil at the base and sever the side roots. Then bend the sapling down on its side and cut off the heart root. Those that are too large to remove in this manner must be felled and their stumps cut off uprooted as described earlier. Fairly large saplings may also be uprooted whole by fixing a chain around them and pulling them out with a truck or tractor.

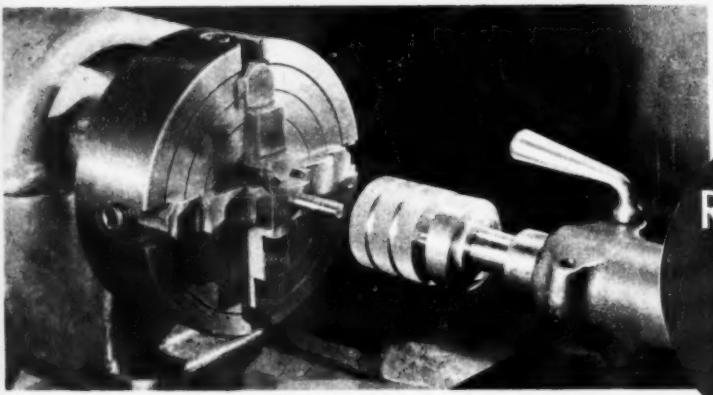
A 4-ft. (over-all length) one-man log saw will be found handy for felling and cutting up large trees. If the teeth tend to clog up when sawing such woods as apple and ash during the season when the trees are holding considerable moisture, rub a little kerosene on the blade to counteract the moisture. During the heat of midday, hornets attracted by the sap of freshly cut apple and other sweet-sap woods are liable to make sawing hazardous. You will not be bothered in cutting up the newly felled trees however, if you wait until late day [*Continued on page* 140]

FIG. 5

Leave stumps bordering drain ditch until ready to stone up to prevent erosion.

Right: Garden seat made from stump by nailing on round top. Below: Don't rake ground bare.





by C. W. Woodson

RELEASING DIE HOLDER

Fig. 1: This holder can be adjusted to disengage when thread has been cut.

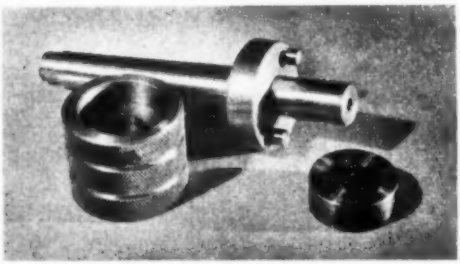


Fig. 2: Shank is in two parts; all pieces c.r. steel.

FOR quantity production of small threaded parts in the machine lathe, this simple releasing die holder, Figs. 1 and 2, will be a great convenience, especially on work which must be threaded to a shoulder or where threads of positive and uniform length must be cut. The holder can be adjusted to disengage when the required length of thread has been cut; the loose die holder, revolving freely on its shaft when this point has been reached, will avoid [*Continued on page* 138]

Fig. 3: Face disc in 3-jaw chuck, then turn to shape.

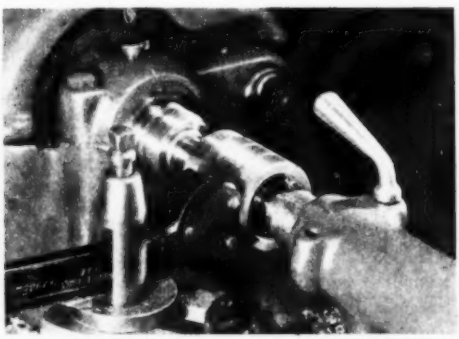
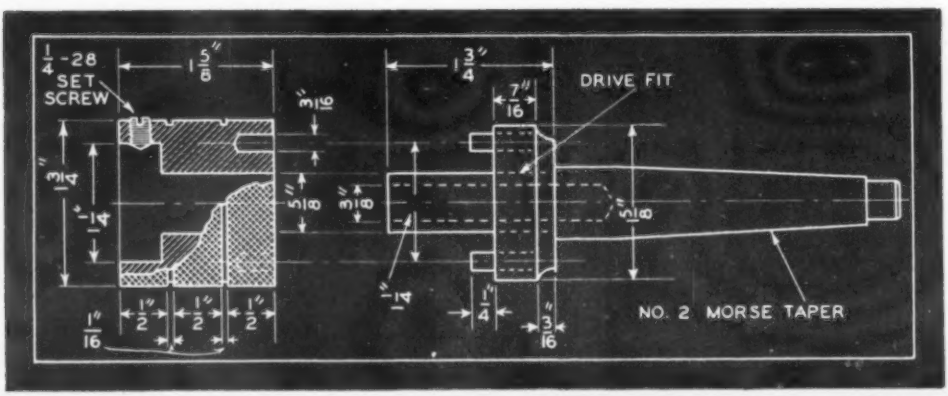
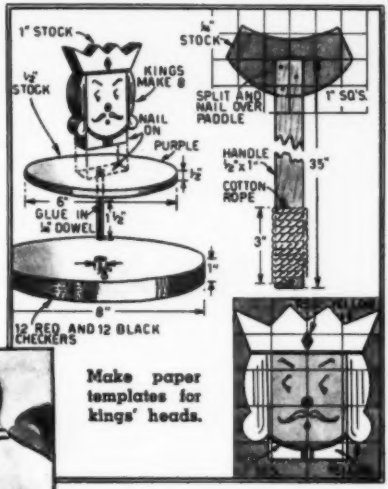


Fig. 4: Use plenty of pressure and oil when knurling.



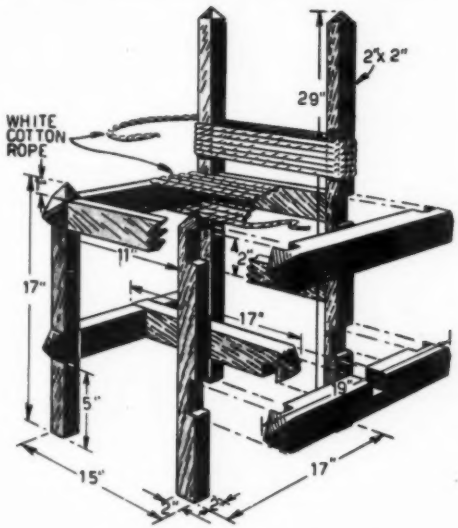
OUTDOOR CHECKER GAME

A SECTION of the back porch, patio, or game room is painted to represent a checker board having 8″ squares. Twenty-four 1″x8″ disks are cut, and half are painted red and half black. Two paddles also are made as shown. The kings are drawn on paper, traced to 1″ stock and jigsawed out. Each is nailed to a 6″ disk of ½″ stock having a 1½″ length of ¼″ dowel glued in to fit the hole in the checker. Colors are suggested in the illustration. The moves are made with the paddles.—*Roberta L. Fairall.*



PATIO CHAIR

THE frame is cut entirely of 2″x2″ stock. Seat and back are made by winding white cotton rope around the frame, nailing it securely at start and finish. The frame is painted dark blue to contrast with the white rope, and peasant flower designs are painted on the legs.



IDEAS FOR SERVICE MEN

CUTTING DOWN THE CLEANING BILL should interest every soldier, and Pfc. Wallace B. Case, Colorado Springs, Colo., has an idea for this that some of you probably know about already—but it's good enough to tell you about just in case. . . . It involves the pliofilm covering from a gas mask. The covering is converted into a neat clothes bag, as follows: Fold one-inch wide pieces of cardboard

lengthwise down the middle. These strips are edge reinforcings for the pliofilm, so make them as long as the sides of the envelope. Next, slice one long side of the envelope open with a razor blade. Staple the cardboard strips along the other three sides, cutting an opening in the middle of the other long side for the hangar hook to come through. An efficient protector for your blouses and trousers will result, as per illustration.

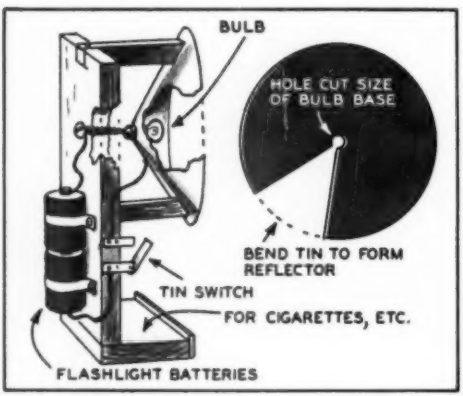
OUR OLD FRIEND Sgt. Wilford Vasher comes to bat again, this time with a novel, and we hope legal, night light. It's made of odds and ends, plus flashlight batteries and bulb; makes a handy affair with which to persue MI from the cozy depths of your bunk. Drawing below gives construction details.

A LETTER from Cpl. Alfred H. Fortier, who is somewhere in the Pacific, reads as follows:

"Your special feature 'Ideas For Service Men' appearing in your magazine has interested me, and many of the ideas suggested there are useful, indeed. Here's one of my own I'd like to pass along via your department.

"All soldiers are required to have their pay books in their possession at all times (at least when overseas). I simply keep mine in my shirt pocket with pen and pencil clipped to it. This arrangement allows the pockets to be buttoned neatly and also makes for quick transference of these items when changing shirts."

BARRACKS BAGS occupy our time for the next few seconds, with the idea of making them occupy *less* of yours. First we have a V-mailer from Sgt. John Pokorny, who says: "When you pack [*Continued on page* 134]



Keep Gloves Safe

TO PREVENT loss if you have no pocket into which you can slip your gloves for safe keeping, try snapping them through a buttonhole of the coat as shown. Use a small light or dark snap, which will not be noticeable, sewing to the inside of cuffs.

Pot Cleaners

PAINTED Turkish toweling makes a good substitute for the steel wool scouring pads it is so difficult to buy these days. Best parts of old towels may be used. Paint both sides and allow to dry thoroughly. These pads can be bunched to fit the contour of any pan.

Substitute Hair Curlers

TEA, coffee, dried beans and many other foods come packed in bags that have a thin strip of metal at the top which is used to keep the bags closed tightly. These strips make a good substitute for hair curlers, which are quite scarce these days.

For Milk Cans

AFTER opening a can of milk, it is wise to plug the two openings with neat little rolls of waxed paper. They will keep the holes from sealing with dried milk, and the milk will pour instantly when the plugs are removed. Moreover, the contents will not spill easily should the can be upset.

Table in use. Shelves in legs hold trays and glasses.

Shelf-Leg Table

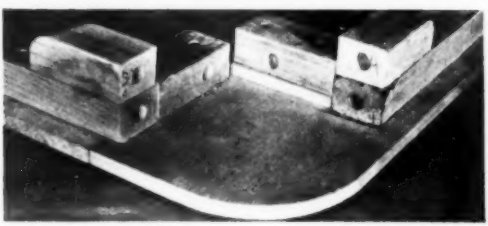
No need to clutter up the playing surface of this table with ash trays and glasses. Shelf-legs hold them.

by Bertram Brownold

THIS card table solves a lot of problems and is an attractive piece of furniture as well. Each of its legs is made of two pieces of wood at right angles, and into these angles, quarter-circle shelves are dadoed. These shelves hold some of the things that otherwise would encumber the table's playing surface. The structure of the legs, moreover, makes it particularly easy to build, and when finished, it is rigid, strong and light.

The construction of the table is simple. Its dimensions are the same as those of an ordinary card table. The aprons are glued and screwed to the underside of the table top, and the legs are pegged and glued to them. For additional strength, two blocks are glued and screwed on at each corner, and the legs are pegged and glued to them.

The top can be made of one piece of plywood or of boards cleated together as shown. A top from a discarded table will do. If thin stock is used to make a light table, use wide cleats and glue them in place as well as using screws. The table top is square with rounded corners, the upper edge being rounded off with sandpaper.



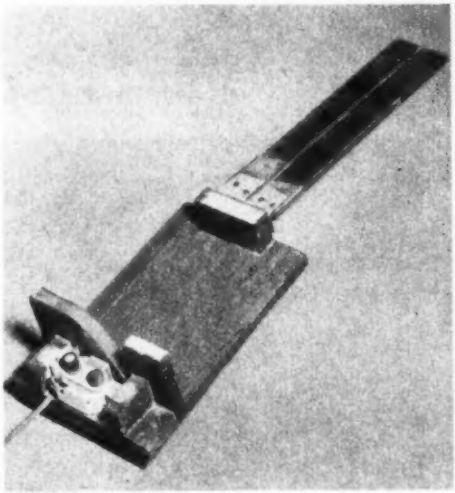
Pegs through legs (below) fit in table blocks (above).

Make aprons in one piece or glue blocks to long strip.

Before pegging legs in place, sandpaper well.

PIANO KEY ENLARGER SWITCH

A rolling movement of your foot operates the switch.



Simple construction is shown in photo and diagram. The main part is electric wall switch shown below.

This enlarger switch is fun to make and use. It works with contact printers, too.

THIS switch can be made of scrap lumber or you can buy ¾″ lumber and cut it to the required sizes. Also buy 1 electric wall switch, 1 triple female drop line receptacle, 1 male plug, enough wire to accommodate your own darkroom requirements, and 4 rubber-headed tacks.

Connect one end of your wire to the binding posts of the switch, and the three-way female receptacle plug to the opposite end of the wire. Splice the male plug in the circuit. The drawing shows the electric wiring diagram. Now screw each side of the switch to blocks 1¼″ high and 1½″ wide, cut from the ¾″ wood. Center the switch at one end of the 5″ by 9″ baseboard and screw it on. Center the 2½″ by 1″ block at the opposite end of the baseboard and nail. Cut your keys 1¼″ wide and 11″ long, and attach these to the 2½″ block of wood with small hinges.

Place the keys on the switch to find the position of the upright blocks, and screw them on, leaving enough play on each side for easy movement of the keys. These upright blocks keep the keys from sliding off the buttons of the switch.

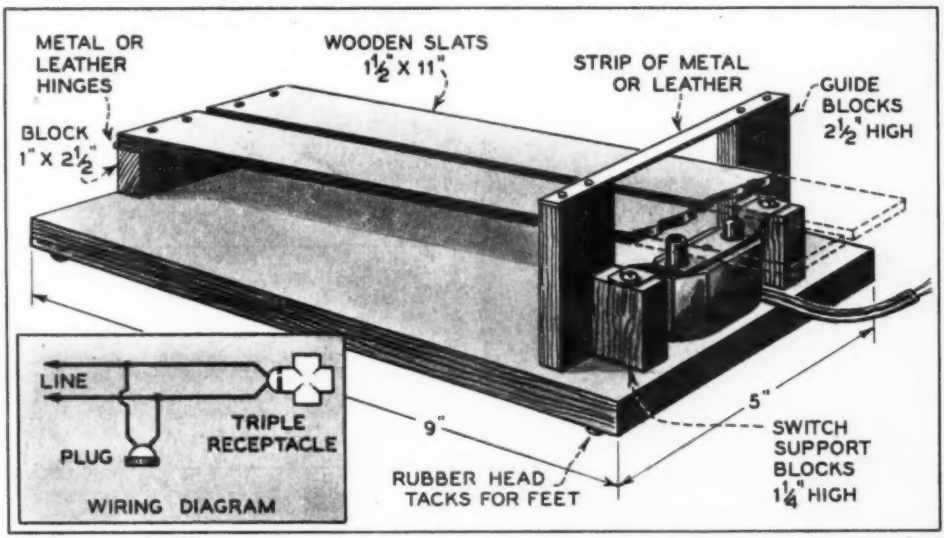
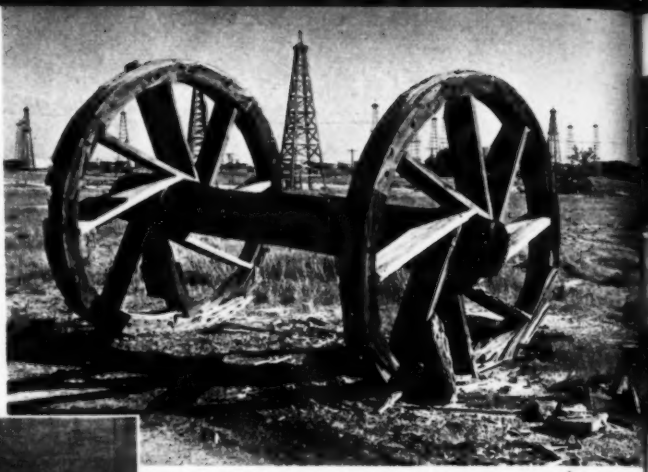
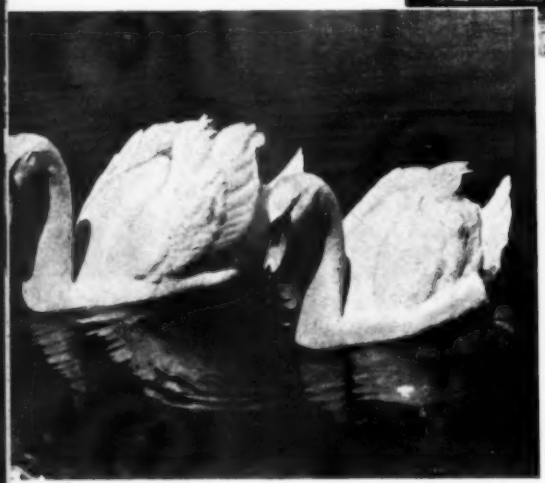


PHOTO CONTEST

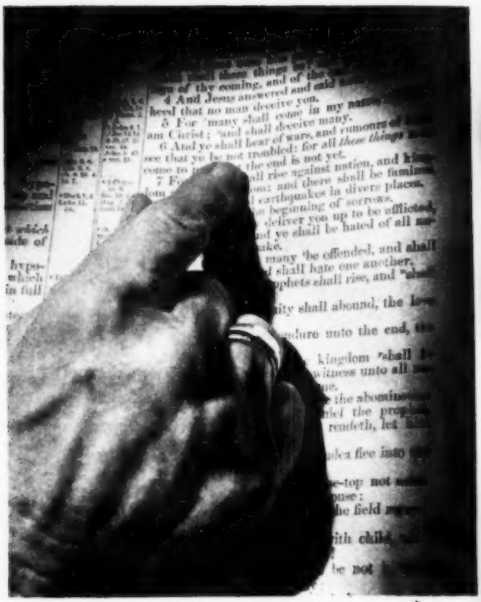
FIRST PRIZE ($10.00): The Old and the New, by Dr. I. K. Moorhouse of Beaumont, Texas; taken with a Speed Graphic. SECOND PRIZE ($5.00): Swan Duet, by Nelson Rice of Novia Scotia, Canada; taken with a Graflex. THIRD PRIZE ($4.00): It Is Written, by Elbert Shea of Bonham, Texas; taken with a Contessa Nettel. FOURTH PRIZE ($3.00): Till Victory, by Sgt. Wesley Reid of Louisville, Ky.; taken with a Voigtlander Rangefinder.



1st PRIZE



2nd PRIZE

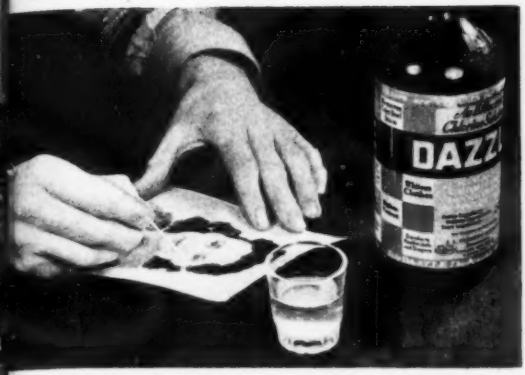


3rd PRIZE

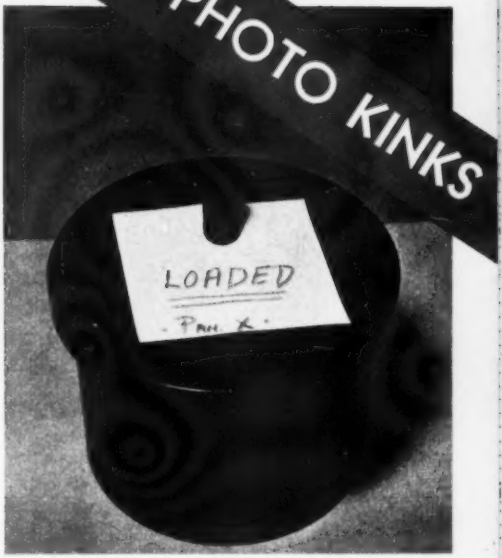
4th PRIZE

Submit contest prints unmounted—no larger than 8x10 inches. With each print list camera, film, lens opening and shutter speed, illumination and developer. Write your NAME and ADDRESS on the back of each print and wrap securely with cardboard or corrugated stiffeners. ENCLOSE POSTAGE for the return of unused prints. Published prints cannot be returned. Address: Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York 18, New York.

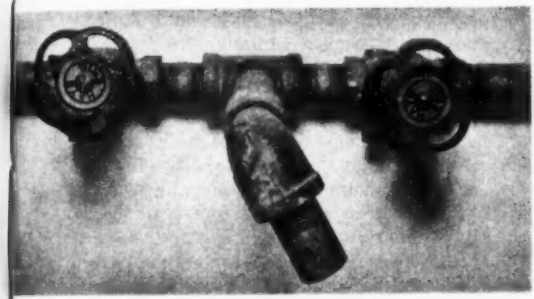
PHOTO KINKS



BLEACHING SPOTS: Ordinary household bleach will remove those annoying black spots on prints caused by pinholes in the negative. Simply put a small amount in a saucer and apply with a toothpick. Touch the print lightly with end and blot.—Wm. Swallow.

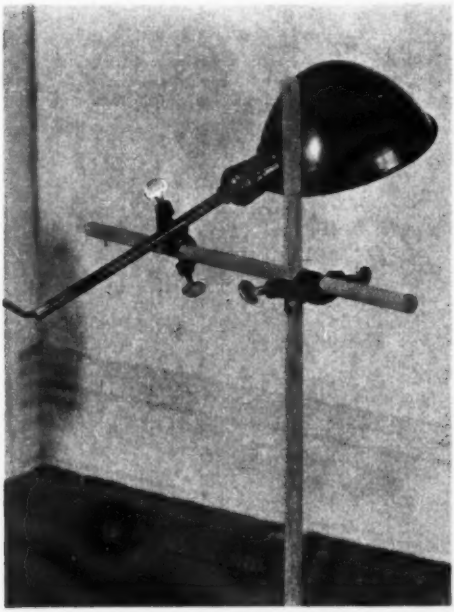


LOADED FILM TANKS: Those amateurs who have developed the habit of loading their film tanks and then letting them stand before developing, will do well to put a warning card on the stirring rod to remind themselves and warn their friends.—L. Hochman.



MIXING VALVE FOR DARKROOM: This mixing valve for hot and cold water can be made from unrationed fittings and is both efficient and inexpensive. A street L on the spout provides a flexible outlet and directs the water toward either side of the sink.—Ben Maxwell.

ETCHING KNIFE: A good etching knife, suitable for most light jobs, can be made from a steel pen point. Select a stiff one and snip off the points just above the ink hole; grind the stub with an emery wheel and polish cutting edge with fine sandpaper.—H. Klein.



ADJUSTABLE LAMP STAND: Two pieces of dowel, one mounted in a base, two two-way clamps obtainable from a chemical supply house, wiring, an electric light socket, a short length of pipe and a reflector constitute a handy and simple lighting unit.—H. Cuthbert.

Pen-Light Portraits

High-powered floodlights aren't necessary to take good portraits! Small flashlights will do as well.

by Roy Lester

The portrait above was taken at an exposure of 1/5 sec. at f-3.5. Two lights were used at left of the model, one at right, and one on each side of camera.

IF YOU are of the opinion that good portraits can be taken only with expensive lighting equipment, think again, pal, for, strange as it may seem, equally good results can be obtained with nothing more than a mess of simple flashlights and pocket pen-lights! If you have any doubts, just take a look at the accompanying illustrations, which were made with nothing else but!

Flashlights may be considerably weaker in light output than high-powered floods, but in many respects they have advantages which definitely make them superior. For example, they are small, require no mess of wires, connections and adapters, are entirely independent of house electric current, and can be carried with ease anywhere. As for the weakness of their light,

The portrait below required an exposure of ½ sec. at f-3.5. Two lights were used at the right above the model's head, one at camera's right, one front face.

This portrait, exposure: ½ sec. at f-3.5, needed three lights at right and slightly above the model's head, and one light at right of the camera, 2 ft. away.

Fig. 1: Arrange the flashlights for desired effect.

Fig. 2: Holding lights will help model to relax.

you don't have to worry about that when your miniature camera sports an f-3.5 or 4.5 lens, and you can load it with "dynamite" films such as Eastman Super XX, or Agfa Superpan Press. Exposures at f-3.5 will run from about ⅛ sec. to 1 sec., which is short enough for the model to hold her pose without moving. An advantage of this weak light, also, is that it does not bother the model and make her squint, thereby contorting her features undesirably; in fact, anyone can look directly into a flashlight without squinting.

A variety of 5 or 6 flashlights and pen-lights should be ample for getting practically any desired lighting effect.

An economic feature of this lighting system is the comparatively small cost of the lights and the long life of the batteries and bulbs. For average amateur use, the batteries will last about 5 or 6 months, and the bulbs even longer.

The light given off by these diminutive lighting units is unique in its quality. Unlike the larger floodlighting units, each of which throws a terrific spread of uncontrolled light, these searchlights throw narrow pencils of light, which can [*Continued on page* 134]

Fig. 3: Lights near camera provide fill-in lighting.

Clamp to tripod, stand or chair where convenient.

A solid model of the LCT to be added to your collection of mechanized military equipment which is winning the war for the Allies.

THIS landing craft is designed for putting heavy tanks and trucks on the invasion beach and is in a class between the smaller LCM (Landing Craft, Mechanized) and the big, ocean-going LST (Landing Ship, Tanks), which can cross the Pacific under its own power.

It is about 100 ft. long and is carried overseas on the deck of a large vessel. In addition to tanks, it can carry soldiers, also. It

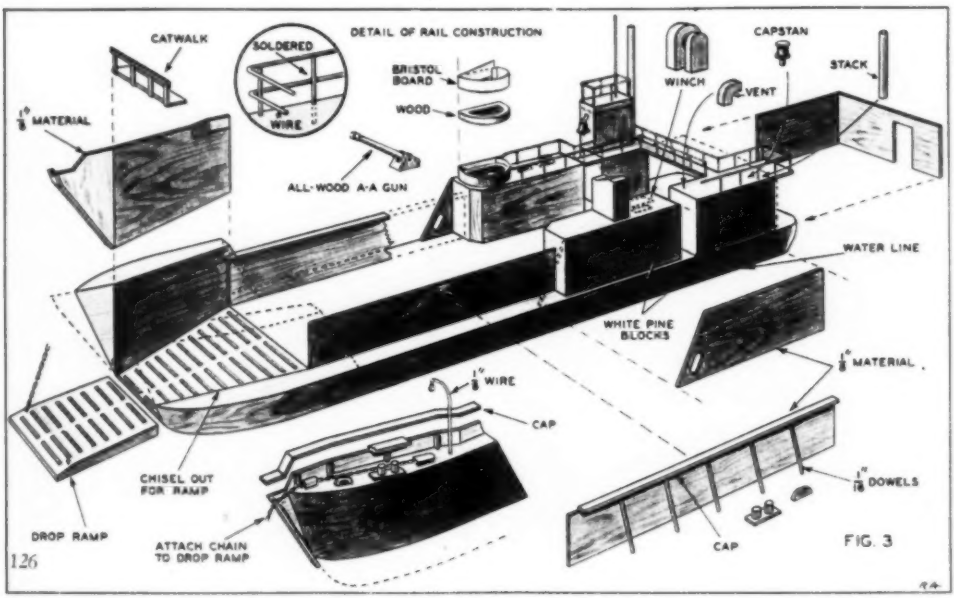
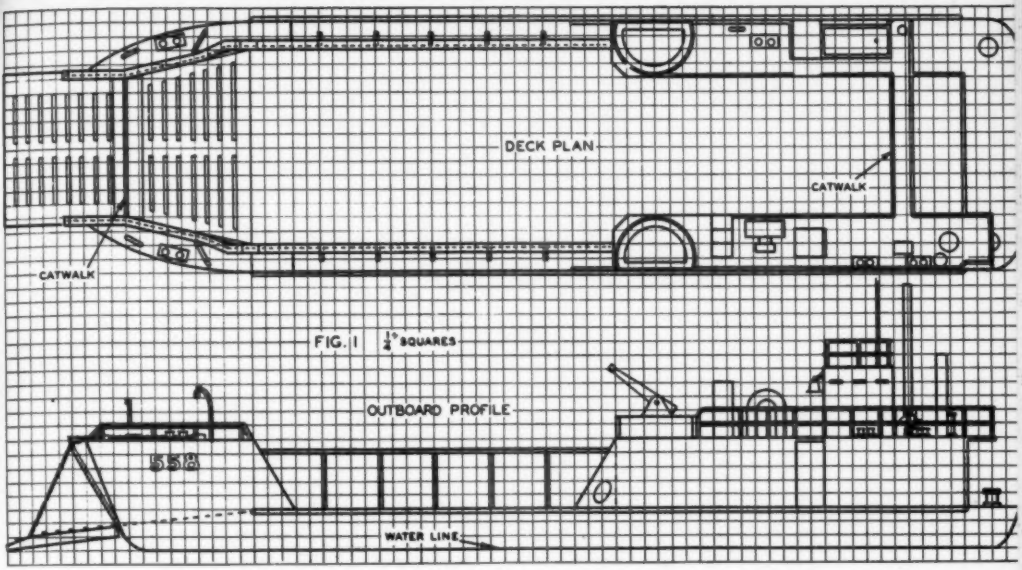


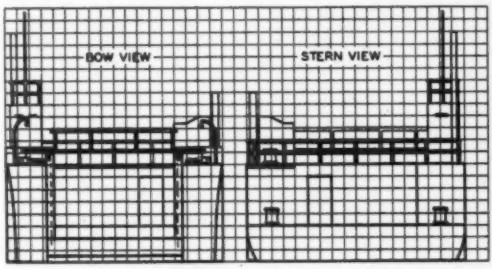
FIG. 3



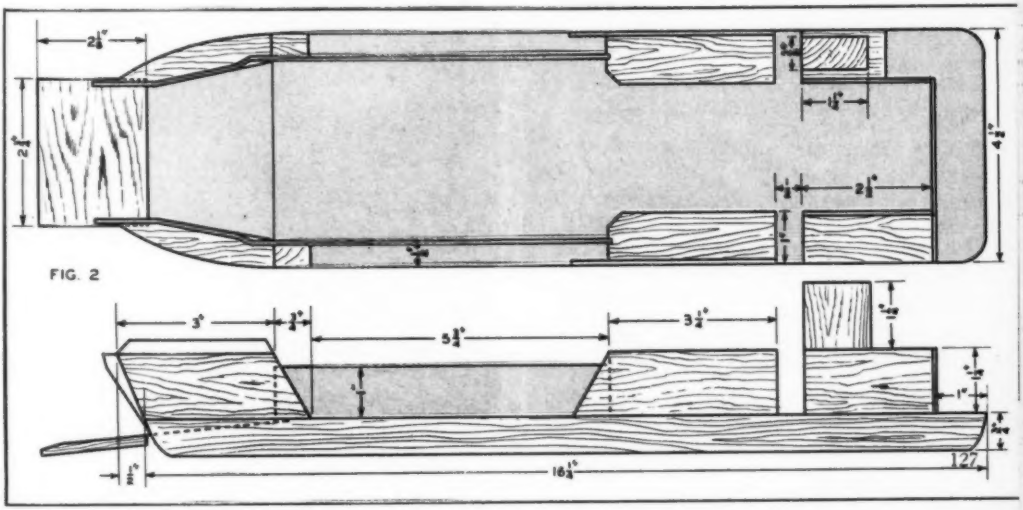
has accommodations for 18 men, a galley and a shower. To back off the beach, it sends a heavy anchor far astern in another craft, then pulls itself off with a powerful winch. A pair of gasoline engines raises the forward ramp.

To make construction easy for the novice, the design has been greatly simplified; the hull is cut off at the water line, and some of the more intricate deck features have been omitted. The over-all length including ramp is 18¾". If you like to work with very small parts, reduce the squares to ⅛" instead of ¼".

Solid wood blocks make for simplest construction, and the principal pieces are shown in Fig. 2. A more [*Continued on page* 132]



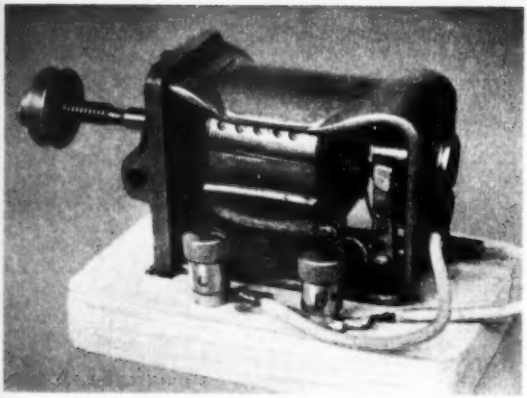
Hull bottom has been cut off to simplify. Begin with bottom or bilge block; ramp is chiseled out. Paint-spray model olive drab for realistic appearance.



MINIATURE

Sturdy little 6-volt, series-wound motors with bronze bearings—made from old windshield wiper units.

by Raymond F. Yates

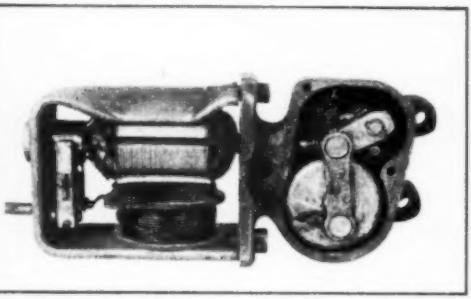


This motor can be made from a Delco wiper. It has a 7-pole armature and chrome-steel shaft. Wiper units can be obtained for about 25c each at the junkyard.

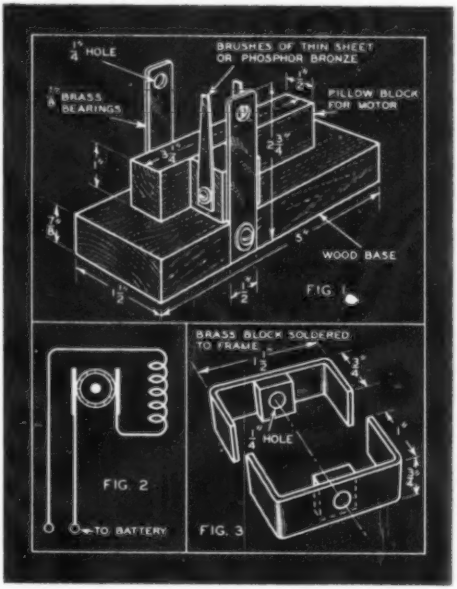
THAT automobile junkyard in your home town probably contains a whole pile of discarded windshield wipers which you can get for a few cents each and with little trouble convert into efficient little motors. There are two types of electric wipers, the Delco and the Ford; the former is the best for our purpose for it requires slight alteration. With a hacksaw and file it can be made available within a half-hour's time simply by cutting off the cast iron gear case at the point indicated in the photograph. The bronze bearing bushing passes through at this point and as little as possible of this should be cut away. After sawing, the remaining end of the casting is trimmed up with a coarse file.

All that remains to be done to place the motor in service is to mount it and connect the motor terminals to binding posts. Connections are made to the motor frame (where one end of the winding is grounded) and to

With a hacksaw, cut off the iron gear case at a point shown in the above photo. Then trim with file.



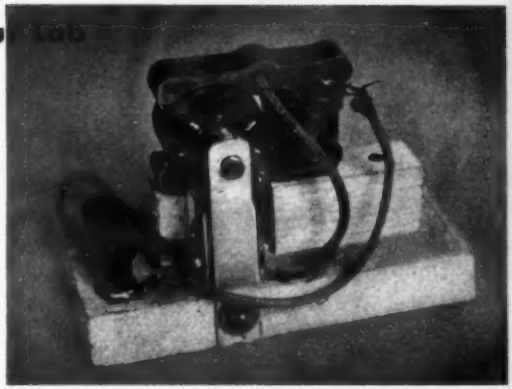
This is Delco unit. Mounting for Ford wiper (right).



one of the motor brushes. The connections of all motors of this type are shown in the drawing, Fig. 2.

Although rated at 6 volts, such motors can be operated on 8 volts d.c. and make excellent power units for model railroads of 0 gauge. The Delco motor has an end-thrust bearing which makes it especially desirable as a power unit for this purpose.

The Ford windshield wiper motor will require more work. It comes in a zinc die-cast case, and is so mounted that you will not be able to preserve its original bearings which are not too good anyway. The motor is cut loose with a hacksaw [*Continued on page* 134]



Motor from Ford wiper is mounted on a wooden block as in Fig. 1. Alternate method shown in Fig. 3.

RATION TOKEN HOLDER

A RETAINER or holder for red and blue ration tokens is a timely and useful project and one that, because of its small size, can be made entirely of scrap material. Very little work is necessary and only hand tools need be used. Neatly made and nicely finished, it is a practical and attractive gift.

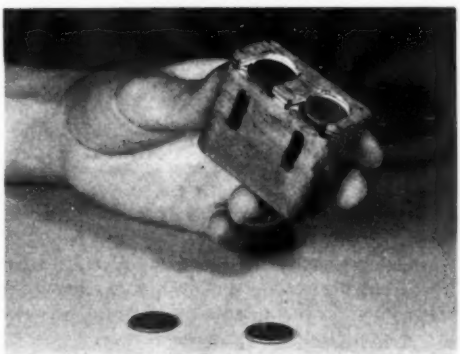
Drill two parallel ¾" holes to a depth of 1¼" in a hardwood block. In order to have the finished token holder small enough to fit easily in a housewife's handbag, drill the two holes as close together as is practicable. As a safeguard against splitting, use a block considerably larger than necessary and cut it down later.

After the block is cut down to the final size, cut viewing slots in its side. Drop a 2" section of spring into each hole; springs from a discarded shade roller are excellent. Expand each spring by pulling it open; you can get the right amount of expansion by experiment.

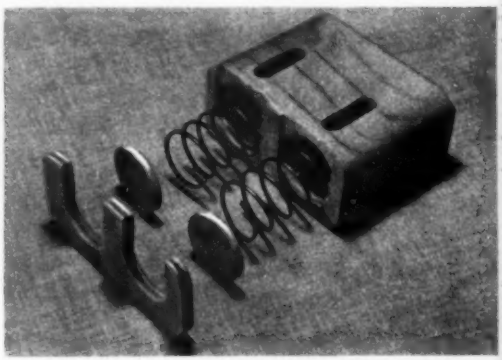
Place a "lid" over each spring as shown. Each lid is a circular disk of hardwood or plywood about ⅛" thick or less. The diameter of the lids is slightly less than the diameter of the holes, so that the lids can move up and down on the springs in an easy sliding fit in the holes.

Nail and glue a plate of ⅛" hardwood or plywood, shaped as shown in the photo, on the top of the block, first having cut away part of the block's upper surface so that when the plate is in place, a space is formed through which tokens can be inserted and removed.

With the plate in place, round off the vertical edges of the block. A coat of shellac will keep your token holder clean. Paint with enamel for a gayer design.—*Charles Brownold.*



This little device holds both red and blue tokens.

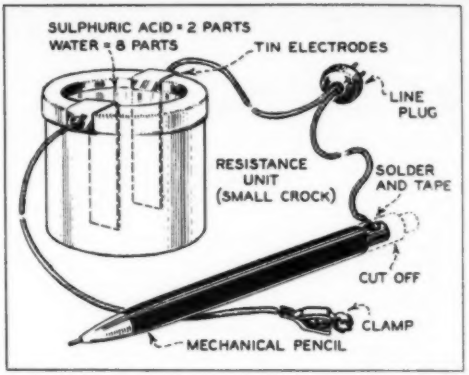


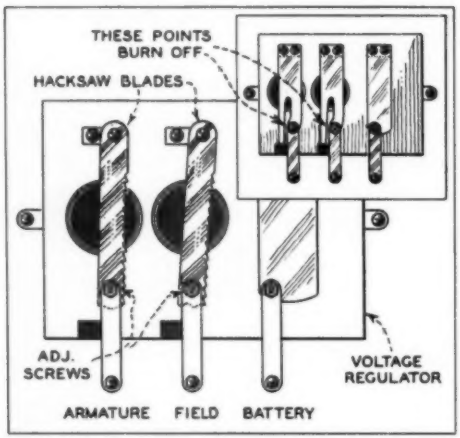
Here are the parts; springs are from shade rollers.

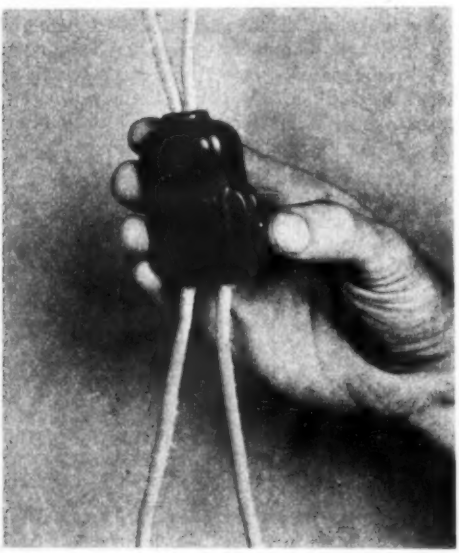
ELECTRIKINKS

Electric Engraving Pencil

THIS unit can be made from a cheap, mechanical pencil with a plastic or wooden case, and operates on 110 volts d.c. Tape wire connection to pencil. Allow ¼" of lead to protrude; arc forms between lead and article being worked.

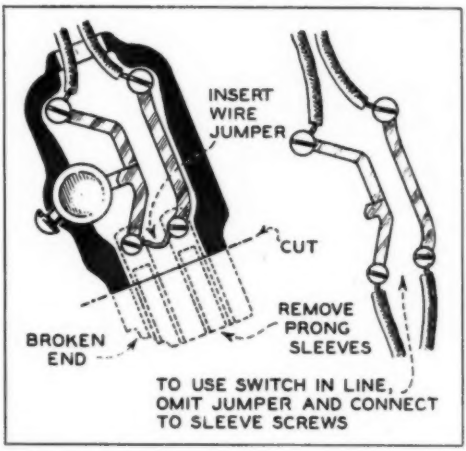






Voltage Regulator

WHEN your car battery has a low charge, the points of the armature and field terminals of your voltage regulator are apt to burn off from the high charging rate, and a new regulator must be purchased. This won't be necessary if you replace the old arms with hacksaw blades and add new points through end holes.



Pendant Switch

WHEN the prong end of a switch-type appliance connector breaks, convert it into a high-ampere pendant switch. Remove the prong contact sleeves, saw off the end of the connector and short the screws which held the prong sleeves with a wire jumper. To insert the switch *in* the pendant line, omit jumper and connect outgoing leads.

The Postwar Plans of Mr. G. I. Joe

Most of his plans are pretty simple, but more vivid and convincing than the best drawn blueprint of a postwar miracle. Some of them look a lot like the picture above. The same old water and rocks, reeds and pines. Plenty of good fishing and savory slabs of just-caught bass sizzling and browning in the pan. And finally the welcome old chow call . . . "Come and get it".

V-mail from a host of "planners" indicate that a sparkling new Evinrude will be an important part of the picture. On battle fronts around the world the boys have watched Evinrudes deliver the kind of performance they respect . . . and want more of when they get back. Our plans are to provide it for them . . . to the very top of their expectations!

EVINRUDE MOTORS, *Milwaukee 9, Wisconsin*

★

Every Dollar You Invest Helps Speed Victory . . . Buy More War Bonds

EVINRUDE

OUTBOARD MOTORS

Practical Postwar Car

[*Continued from page 107*]

leading car manufacturing concerns recently declared that unless competition otherwise dictated, postwar cars probably will be heavier than prewar models.

In appearance the contemplated job for everyman's use will offer some surprises. There will be the familiar sweeping lines and long hood, but the rear won't sweep down so wastefully. This end will be relatively high, not only to allow room for additional luggage but for the spare, which will rest on a pull-out rack inside the compartment's top.

The hood may be of a one-piece type that raises from the backend rather than be of the conventional alligator variety. In freezing weather the hood could be raised an inch or so by means of a solenoid operated from a dashboard button. This would allow warm air from the motor to sweep up the windshield, effectively preventing frosting. Doors will be fitted with the new flush doorlocks used in the aviation industry.

Steaming would be eliminated through use of a semi-airconditioning system composed of a good hot water heater, a husky ventilating fan and an air intake in the cowling. The car would feature wide-base rims so as to lengthen tire life and provide easier riding.

Brakes may be four-wheel electric with a manual brake on the propellor shaft for emergencies or for parking. The clutch may be an improved fluid type, but at least the transmission would be conventional. If the British driver still can enjoy skill in handling gears there's no point in American operators giving up some of the sport of driving at the expense of sun gears and the other complicated paraphernalia of automatic overdrive. Rear end gearing would be hypoid. Built-in hydraulic jacks front and rear would make tire changing a cinch.

LCT Landing Craft

[*Continued from page 127*]

detailed view of assembly is given in Fig. 3. Gun turrets are simply bristol board lapped and glued to the wooden base-piece, and the AA gun is whittled from soft pine. Railings are made of wire, bent and soldered as shown, the stanchions being set in the wood first and the rails then soldered to them. The winch, capstan, bits, vent and other small items are of wood construction and installed as in Fig. 1. Chains from the ten-cent store are attached to drop-ramp and then carried up over decks.—*Hi Sibley.*

One of the last steps in airplane production at one American factory is to camouflage the plane: dull green-brown color is for many military planes, with the lower parts painted gray, and deep jungle green for planes destined for the Dutch East Indies.

Boy's Desk And Table

[*Continued from page 86*]

lower shelf. Make the screw holes at the center and outer edges oversize to permit movement. Drive glue-coated dowels through the back into the drawer guides.

As a precaution against splitting of drawer fronts against the ends of the guides when slammed violently shut, tack blocks of wood to the back where the ends of the drawer sides can contact them.

The construction of the table is quite similar, but as there is no back, a rail, similar to the end rails, runs the length between the legs, and the top is anchored at the center with provision for movement at both edges. Fit the shelves to the legs and dowel the notches upon assembly. Then join the end units with the rail and guide assembly. Dowel the outer edges of the shelf backs to the shelf edges, and dowel both edges of the center boards. The rabbeted edges of the latter will hold the edges of the wider boards. These also should be painted before installation. Center the drawer pulls on the shelf backs.

MATERIAL LIST

Desk

No. Pc.	Description	T.	W.	L.
3	Top; Rough Sizes	¾	8	35
1	Top	¾	¾	35
2	Back	¾	8	30
2	Back	¾	10	32
2	Upper drawer guides	¾	1	19
2	Lower drawer guides	¾	1⅛	19
2	End rails; Finished Sizes	¾	6	16
2	Shelf cleat	¾	2	16
4	Legs	2½	2½	29¼
2	Muntins	¼	1⅞	5¼
2	Shelf wings	¾	5½	8½
1	Upper shelf	¾	6¾	29½
1	Lower shelf	¾	7½	29½
1	Upper drawer rail	¾	1	29½
1	Lower drawer rail	¾	3¼	29½
2	Drawer front	¾	4¼	13⅝
4	Drawer sides	⅝	4⅛	19¼
2	Drawer backs	⅝	3½	12⅞
2	Drawer bottoms	¼	18¾	12⅝
4	Bottom strips	¾	¾	18½
49	Top, back, shelf, etc., dowels	⅜	round	2
20	Leg and rail dowels	⅜	round	4
24	Flat-head wood screws			1½
6	Flat-head wood screws			1¾
6	Round-head wood screws with washers			1½

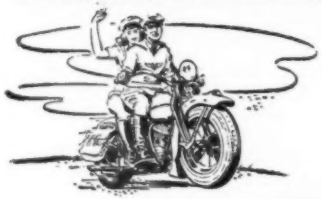
Table

2	Top; Rough Sizes	¾	8	38½
1	Top	¾	10	38½
2	Top	¾	¾	38½
4	Shelf backs	¾	8	20¼
2	Shelf backs	¾	6	20¼
1	Upper drawer guide	¾	1	19
1	Lower drawer guide	¾	1½	19
2	Shelf back cleat	¾	1¾	19
4	Legs; Finished sizes	2½	2½	29¼
2	End rails	¾	5¼	16¼
2	Top cleats	¾	¾	18½
4	Shelves	¾	6⅞	20
1	Back rail	¾	5¼	31¼
1	Upper drawer rail	¾	1	33½
1	Lower drawer rail	¾	3¼	33½
2	Muntin	¼	1⅞	4½
1	Drawer front	¾	3½	30¾
2	Drawer sides	⅝	3⅛	19
1	Drawer back	⅝	2¾	29½
1	Drawer bottom	¼	18½	29¼
35	Dowels for top, shelves, etc	⅜	round	2
18	Dowels for legs and rails	⅜	round	4
14	Flat-head wood screws			1½
6	Round-head wood screws with washers			1¾
2	Drawer pulls, rectangular fronts			

FIRST ON MY *Want List* IS A NEW HARLEY-DAVIDSON

"Your motorcycles are doing a swell job . . . Believe me they really catch hell here in New Guinea. But they can take it. Better performance, speed, and easy to ride. It's the A-1 motorcycle for me, and I salute you—the makers of the one and only Harley-Davidson.

"One of the first things on my Want List after the war is a new Harley-Davidson. Your machines are helping to win the things the boys want."



Corp. V. A. N. — it will be swell when fellows like you are back to ride in race meets, hill-climbs, endurance runs and other exciting motorcycle events. Thousands of riders have Harley-Davidsons at the top of their Want List — and "BUY BONDS" is their slogan so they CAN own one.

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Home-Built Jigsaw

[*Continued from page 99*]

directly from the saw. The hole can be drilled and filed out to provide a slight side adjustment on the saw so that it can be brought exactly vertical. The bronze guide is slotted $\frac{1}{16}$" deep to take the back of the saw, and is threaded $\frac{3}{16}$" x 24 with two lock nuts for fore and aft adjustment. The guide being completed, it can be fastened to the inside of the bearing as shown at B, Fig. 14, with four $\frac{3}{4}$" screws.

The table assembly is shown in Fig. 12. Make the under frame from 1" x $\frac{7}{8}$" stock, mitering the corners and fastening with glue and 2" screws; be careful to get the whole thing square and level. With the frame complete, the top, which is a 12½" square of Presdwood, can be fastened in place with $\frac{3}{4}$" screws.

The two trunnions now can be cut out and assembled as shown at C, D and E. The two parts D are cut from $\frac{7}{8}$" stock and must fit the two slides D and E, Fig. 1, perfectly, otherwise the sawing of accurate angles will be impossible. Note also that C and D on the front trunnion, and D and E on the back trunnion are assembled with a thickness of heavy paper between to provide clearance on the slides. The cross bar to which the front trunnion is bolted now can be cut to length and the trunnion fastened in place with two $\frac{3}{16}$" flat-headed bolts as shown, the back trunnion being attached to the inside of the table frame in a like manner. Now place the front trunnion with cross bar attached in the front slide and the back trunnion in the back slide and mark the position of the front cross bar. The bar and trunnion can be fastened permanently in place with glue and a couple of 2" screws.

The front flange on the front trunnion is slotted and provided with a 1/16" brass plate marked off every 5° from 0 to 45. This plate is attached to the flange with two 2-56 machine screws.

Miniature Motors

[*Continued from page 129*]

and mounted in one of the two ways shown in the drawing. In the one case, bearings are supplied by soldering heavy sheet brass strips directly to the laminated frame of the motor; small brass blocks are soldered to the strips to form the bearings, Fig. 3. The bearing holes are drilled out before the brass strips are bent to shape and soldered to the motor frame. To avoid a great deal of soldering and resoldering in an effort to arrange the motor armature concentrically with the frame, paper strips are wound around the armature before it is set in place in the frame. The bearing members then are set in place and the soldering is done. The armature should revolve freely when the paper is removed.

About 350 compounds of synthetic rubber for various industrial purposes have been perfected.

Pen-Light Portraits

[*Continued from page 125*]

be controlled and directed as expertly as a painter controls his brush.

Use powerful focusing searchlights for dramatic highlighting and edge lighting. For fill-in, use the cheaper flood-type searchlights, and for special effects, take advantage of the tiny pen-lights. A convenient way of supporting them is to attach them to universal clamp-on units, as shown in the photos. In this way, they can be clamped to any convenient object and directed wherever needed. In fact, you can even give your model a light or two to hold and direct at herself, as shown in Figs. 1 and 2, and these will not only serve to produce the desired lighting effect, but also will set the model at ease by occupying her hands and relieving her of self-consciousness. For flat fill-in light, clamp a few searchlights to the camera tripod, as in Fig. 3. For soft shadowless effects, hold the searchlight in your hand and keep its light beam in constant motion on the subject during the exposure.

The Gentle Job Of Grinding

[*Continued from page 93*]

with the work set in the machine and the polishing compound or material held in the hand.

A piece of steel, aluminum or brass can be polished right after machining, and emery cloth usually does the trick. The work is revolved at high speed and the cloth is held against it.

When it comes to polishing plastics, the best bet is usually to apply rouge or polishing compound to a cloth wheel. This is mounted in the lathe and the work held against it; for best results the wheel should run at high speed. It is good practice not to press the plastic piece too hard against the wheel, since that is a very good way to burn it.

Ideas For Service Men

[*Continued from page 118*]

your barracks bag, instead of wrapping your shoes in paper to keep contents of bag from being soiled, try putting the shoes inside of heavy socks. Makes a neater job and prevents shoes from getting scratched."

Second idea is from Pvt. Francis W. Germaine, Brooklyn, N. Y.: "Here is a suggestion for men who must live out of a b.b. or sea bag. Obtain an old slide fastener about ten inches long, cut a vertical slit in the middle of the bag and sew in the fastener. It will not be necessary to take down the bag and tie it up again every time you want a small item."

When newly hatched, a ruby-throated hummingbird is no bigger than a pea.

A Camera Fan is MADE . . . not born!

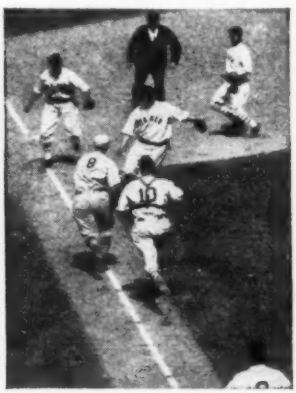
Most beautiful picture ever made? Bob's mother insists it is because it's the first snapshot he ever made. . . . and he made it of her! It was taken with a Universal, one that Bob bought out of his allowance.

Mother was embarrassed when Bob graduated to candid shots like this. Made with a Universal, of course. For even then Universal led the field with a candid-type camera priced so low even youngsters could afford it.

Here's the last one he took of his mother before entering the Navy. Also made with a Universal, the Mercury he got when he graduated from college. Bob carries this picture with him everywhere.

Bob's using Universal Navy binoculars now —for Universal's at war too, making military optical instruments instead of cameras. But Bob took his Mercury with him. He's made some great shots in his spare time.

The war will end . . . and a home and family of his own will redouble Bob's interest in photography. And what photography! Universal's wartime achievements will result in a great new series of cameras.



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[*Continued from page* 105]

pack under your arm. If you must carry it by the harness, grasp it by the leg straps ONLY. Taking this advice will prevent damage to the seams of the harness and reduce the possibility of the ripcord being released accidentally. Before putting on a chute, lift the ripcord flap and examine the cones and prongs carefully. Usually the rigger fastens the prongs in the cones with strong thread to prevent their working loose. Of course, this thread is snapped easily when you jerk the ripcord to open the chute. Some riggers, however, have a habit of fastening them with wire, especially when the chute is to be shipped to the owner. Make sure there's NO wire holding them to the cones in your chute. If there is and you have to use it, you're a dead pigeon. Examine the pack closely for stains every now and then. They may indicate deterioration within.

In order to be sure of the reliability of your chute, it must be opened and repacked every 60 days (by a licensed rigger, of course). Repairs are made where necessary. Things to look for are mildew, rust, water and oil stains, battery acid, vermin, etc. If the canopy is allowed to remain folded for any length of time, it will crack along the creases and will be ruined; for this reason, when storing your pack for an indefinite period, remove the canopy and place the entire assembly loosely in a large bag containing a quantity of naphthalene flakes. Every few months open the bag and rearrange the canopy. Packed parachutes must be stored in a dry place out of the sun. When wet, they must be opened and hung up from the apex of the canopy to dry—*never in the sun.*

When you're given a chute to wear which you have never seen before, check it superficially as mentioned previously and look at its log card which you will find in a small pocket on the top of the pack. It will inform you of the age of the chute, the number of times it has been repacked and the date of each repacking including the last one.

Now for the use of the chute! Let's hope you won't have to use one, but if you should, here's how!

If your plane will still respond to the controls, as it will in case of fire, pull it up into a complete stall and jump just before the dive which follows. In a spin in which recovery is impossible, jump from the side of the plane on the outside of the spin. In any case, keep your wits about you and estimate coolly all the possibilities. Jump headfirst with your legs straight out behind you. Don't be afraid that you'll lose your head and forget to pull the ripcord; just remember not to pull it *too soon.* Wait until you are free of the aircraft!

When falling, you won't lose your presence of mind. The sensation is the same as that experienced when standing in the slipstream of the prop. When pulling the ripcord, use a quick jerk rather than a steady pull. When the chute opens and stops your fall, look at the suspension lines and straighten out any twists which they may have. If you are swinging back and forth, check this motion by pulling on the lines on the high side as you swing downward, the same method you used to employ in your younger days on the old park swing.

While descending, if you see you're going to strike an obstruction on the ground, change the angle of glide of your chute by pulling on the lines on the side in the direction in which you desire to travel. Don't pull too much, however, for if you spill your chute entirely, it might not open again. Turn your body vigorously until you are facing the direction in which you are drifting. If it seems that you're going to fall short of the place in which you desire to hit the ground, don't try to reach it by slipping the chute; this will only make you fall still shorter of your mark.

Land with your back to the wind and your legs bent slightly with your feet about 12 inches apart, just as though you were preparing to make a broad jump. As you approach the ground, grasp the shroud lines in each hand and pull yourself upward as you land. This will help break your fall. Tumbling forward toward the chute will help also. Spill the chute of air by grasping the lines nearest to the ground and running toward it. If you ignore this last piece of advice and there's a stiff wind blowing, you're apt to go for an unpleasant cross-country ride. When landing in water, loosen the leg and chest buckles when you are about 100 feet up, and keep in the harness by holding your arms close to your sides. Just before you hit the water, raise your arms over your head and you will slip clear of the harness and be free to swim to safety.

Then you can collect your chute and walk off—a full-fledged member of the Caterpillar Club.

The School Shop aviation lessons are being published in book form titled HERE'S HOW TO FLY. The publisher is Duell, Sloan and Pearce of New York City.

There are 21 chapters and over 200 illustrations covering history, aerodynamics, navigation, meteorology, engines, load factors and parachutes, and a special chapter of 200 multiple-choice questions and answers like those used on C.A.A. Private Pilot Examinations. The price is $2.50. Copies may be obtained by writing to the Aviation Editor of MECHANIX ILLUSTRATED. Make check or money order payable to Duell, Sloan and Pearce.

The "Rambler" Roars into Rangoon

This morning you're flying with the crew of the famous "Rangoon Rambler" . . .

Crouched in the glassed-in nose beside you, Lt. Guy Spotts, the navigator, studies a map spread across his knees, checks off landmarks as they slide past underneath. Suddenly he peers ahead . . . speaks into his throat-microphone: "Pilot from navigator. There she is, Rote. We can see the target now. Alter course to three-three-zero."

"Roger!" Capt. Raymond Rote, the pilot, eases the big B-24 around and straightens out on his new course.

Then *you* see it . . . a splash of flame against the green horizon . . . the great, gold-domed Shwe Dagôn Pagoda that towers over Rangoon. You're getting close . . . and the crew gets set. Lt. Robert Currie, the bombardier, fiddles with the knobs on his bombsight. Capt. Gordon Wilson, co-pilot, gives the instruments a last-minute check.

Now you're over the target . . . a flock of pot-bellied Jap cargo ships squatting there in the river's bend. The "Rambler" lurches and bucks as she ducks through bursts of ack-ack and goes into her bombing run.

Your heart pounds hard. Then Currie comes in on the intercom . . . cool as if he were ordering cokes at the Assam Officers Club: "Pilot from bombardier. Bombs away! Let's get out of here, pal!"

Looking back and below, you watch the formation's bombs bullseye the target. A freighter goes up in a blast of fire and black smoke. The ship beside it explodes. Flames break out from a third. And a fourth. Currie and the other bombardiers were "on the beam" today.

Rote banks the Lib around steep, and you high-tail for home. You're congratulating yourself when . . . "Fighters at four o'clock—high!" somebody yells. You look up and see a formation of Japs sweeping out of the sun.

Now it's the gunners' turn. And between squirts of their big, twin-50's they keep up a running pep-talk:

"There goes his wing down! He's coming in! This one's *my* meat, Salley!"

"Hey, skipper—kick her over a little. I want a good shot at this guy."

And two Japs spiral down in flames, and the rest decide to quit. That's all for today. You look around at the crew, relaxing now, shooting the breeze, adding up the score. You think of the ribbons each man has won for flights like this.

And it makes your chest puff out with pride to be flying with guys like these . . . to be wearing the wings of the AAF—the "greatest team in the world!"

U. S. ARMY RECRUITING SERVICE

THE "RANGOON RAMBLERS": Standing: Sgt. Ferdinand Knechtel, gunner; Capt. Raymond Rote; Capt. Gordon Wilson; Lt. Guy Spotts; Lt. Robert Currie; Sgt. Joseph Willis, gunner. Seated: Sgt. John Craigie, Sgt. Carl Faak, Sgt. Adolph Scolavino, Sgt. Edward Salley, gunners.

MEN OF 17 . . .

if *you* want to fly on the "greatest team in the world," an AAF air combat crew . . . go to your nearest AAF Examining Board . . . see if you can qualify for the Air Corps Enlisted Reserve. If you qualify, you will receive this insignia . . . but will not be called for training until you are 18 or over.

When called, you will be given further tests to determine the type of training you will receive. If you are trained as a gunner or technician gunner, you will go into actual combat as a non-commissioned officer. If your aptitudes are outstandingly high, you may be trained as a bombardier, navigator or pilot; and graduate from training as a Flight Officer or Second Lieutenant.

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For information on Naval Aviation Cadet Training, apply at nearest Office of Naval Officer Procurement. This advertisement has the approval of the Joint Army Navy Personnel Board.

AAF
ARMY AIR FORCES

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Releasing Die Holder

[*Continued from page* 116]

over-running of the tool and possible damage to the work and lathe.

Both the revolving die holder and the tapered shank are made from cold-rolled steel. The shank is made up in two parts, as indicated in the drawings, the disk, with the two pins inserted, being a drive fit on the number two Morse taper shank which is shouldered down on one end to receive it. The shank can be turned between centers using the taper attachment or the set-over tailstock method. In either case, the cut and try system should be employed until a perfect fit in the tailstock spindle hole is obtained. When this has been accomplished, the tapered shank is mounted directly into the headstock spindle hole where the outboard end can be turned down to size and the ⅜" clearance hole drilled as indicated in the drawings. The disk can be faced in the three-jaw chuck, drilled for the two pins, accurately bored and firmly driven on the shank. It then can be turned to shape, as in Fig. 3, and the hardened drillrod pins driven tightly in place.

The die holder is made up in the three-jaw chuck, bored to receive the die and drilled and reamed for a sliding fit on the shank. The two drive pin holes are accurately drilled to receive the pins on the shank disk. The holder is then slipped on the shank which is mounted in the headstock spindle hole and supported by the tailstock center, as in Fig. 4. Here a light truing cut is made and the piece knurled, using plenty of pressure and plenty of oil on both the lathe center, the work and the knurling tool. The setscrew hole for holding the die firmly in place, then is drilled and tapped, and the die holder is ready for use.

Boring Dowel Holes

[*Continued from page* 101]

cuts by sliding the carriage in one direction only, as there is enough spring in the setup to cause the router to widen the groove slightly when cutting on the return stroke. This, of course, is of no consequence if the tongue or spline thickness is made to fit the groove. Because of column interference, there is a limitation to the length of stroke possible with the carriage. With wide stock, however, two tenons rather than a single long one are desirable. Set up for grooving one end, and groove for one tenon on corresponding ends of all pieces. Then tilt the table in the opposite direction, swing sidewise to re-center the bit, and make one mortise on the other end of each. Then slide off the carriage, swing the table completely over, and replace the carriage right-side up.—*Edwin M. Love.*

A recent act of Congress protects the bald eagle against hunters and collectors within the United States and its possessions, excluding Alaska.

The Potter's Art

[*Continued from page* 110]

rate of two and one-half pounds to a quart of water. Mix gently with your hand, fishing out any possible lumps. Next let the mixture stand, stirring occasionally, until it starts to thicken; then it is ready to pour over the pattern. Pour so as to form as few bubbles as possible, and then let the mass stand until the plaster has grown hard and feels warm to the hand. The warmth is an indication that the setting is complete and that the linoleum can be taken off. Unfasten the linoleum, pull off the board, and dig out the clay pattern. The mold is ready to be dried out preparatory for casting.

The steps with the wooden pattern are for the most part the same with only a few additions. For example, the wood of the pattern should be treated with linseed oil or shellac so as to make it waterproof, and the pattern screwed to the center of the circular board so as to make it possible to draw the form from the mold. The drawing can be done then with thin wedges or a case knife.

Two-piece molds are made by much the same process. The pattern is turned upside down on the circular board and a wall of clay built to the parting line or line of greatest diameter. The plaster then is poured over the bottom half, and when the plaster has set, the linoleum is removed and the clay taken away. This leaves the pattern half buried in plaster, and at this point two new steps are necessary. With the pattern standing in a normal position, top up, two small depressions should be cut in the plaster. These are called joggles and are to keep the pieces of the mold always in the same position. A coating of soft soap should be rubbed on the plaster to keep the two halves from sticking.

The Casting Process: Casting is an interesting process. The molds, which must be thoroughly dried, are filled with liquid slip and allowed to stand for twenty or thirty minutes, depending on the size of the mold and the quality of the slip. The molds then are emptied back into the slip barrel at which time a layer of clay will be found coating the entire inside of the mold. This is the clay casting, and the mold must be set away for this to stiffen and shrink. This stiffening process will take several hours, and can be detected by the clay growing dull and shrinking from the sides of the mold. As soon as the clay has become stiff enough to stand alone, it may be taken from the mold and allowed to stand for a few hours longer before it is handled. When it is strong enough to be handled without marring its shape, the spare on the top should be trimmed off on the potter's wheel, the parting line smoothed down, and all defects removed. This cast piece now should be set aside to dry, and when dry, sanded lightly and fired. Cast pieces will dry much faster than the thrown ones as the body is not as dense.

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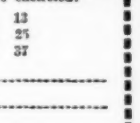

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Landscape Architecture

[*Continued from page 115*]

or early morning when it's cool. In sawing up heavy logs into short lengths for firewood, start at the small end and work toward the large end. The weight of the large end will then serve to anchor the log against the stroke of the saw for all the cuts.

Wedges are helpful and often necessary for splitting big logs. Satisfactory wooden ones may be cut from a 4" maple branch as shown in Figure 4. Wooden wedges are often preferred to iron wedges because they can be driven with an axe without damaging the ax head, thus eliminating the need for carrying a sledge. The strength of wooden wedges can be increased considerably by allowing them to season for several months before using them. It pays to keep in mind the fact that logs split quite readily when frozen, at which time little wedging is needed to part the fibers.

Burn your brush in small amounts as you progress with the clearing instead of letting it accumulate. Where this is not practical, stack it compactly and high, for it will settle as it dries out. The safest time to burn a brush pile is after the ground has been covered by a light fall of snow following a dry spell. A light snow cover prevents the fire from spreading by quenching flying embers but does not wet the brush enough to make kindling the pile difficult. To start the fire, place a kerosene-soaked rag well into the bottom of the pile and ignite it with a long taper. Check with the fire warden of your locality before burning brush. As a rule, a permit is required during the dry seasons.

To prevent the soil of newly cleared land from eroding, it should be converted from woodland to grassland as soon as possible. The growth of grass can be promoted by rolling or otherwise compacting the topsoil where it has been dug up and by checking rank weed growth during the spring and summer weed growing season.

In cleaning up a newly cleared piece of land, don't rake the ground bare. A thin layer of trash, evenly distributed, is desirable, as it will rot and enrich the topsoil. Avoid leaving a thick layer of trash, however, because this will act as a sponge, absorbing moisture needed by grass roots while depriving them of sun and air.

Due to the soil-retaining value of their roots, stumps bordering a drain ditch that cuts through a newly cleared plot should not be removed or killed off until such time as the banks and bottom of the ditch can be stoned up. See Fig. 5. For appearances' sake, in the meantime, the shoots may be pruned occasionally to keep them from growing high. The job of stoning up the ditch should not be put off too long, however, as the banks might be subjected to severe damage by thaw during late winter and early spring warm spells when they are no longer protected from the sun by dense thicket. The erosion of an unpaved ditch can be retarded to a certain extent by dumping leaves into it.

Open Sesame

[*Continued from page 41*]

other time. But the Board Chairman, a temperamental man not to be brushed off lightly, stormed: "Look here, Mr. Zion, you're just trying to get out of this."

Feeling that the glove was in the ring now, Barney accepted the offer of a bobby pin from one of the secretaries, and tickled the inside of a door lock with it. The lock turned and the door opened quite easily. "Well I'll be a—" said the refined Chairman, sitting down hard behind his desk, "you're a second Jimmy Valentine." There was a new respect and even deference on his usually dignified face. Telling about it now, Barney says, "You know, when the lock sprang open that man wasn't a bit more surprised than I. I'd never opened a lock with a bobby pin before, and I've never done it since."

Although most people look on Barney Zion as a magician who has only to whisper the words "open sesame" to any lock, Zion himself likes to poohpooh the idea that he is a mechanical genius. "I'm really just a salesman," he explains. "I'm the victim of a plot."

The plot was hatched one day in 1928 when Zion's sister-in-law told him that the President of the Independent Lock Company, which had just manufactured a new type of key-cutting machine, was looking for a salesman to sell the idea to the country's locksmiths. Zion, who was already making $10,000 a year, thought that was enough money for one man, but out of courtesy hopped a train for Fitchburg, Mass., took one look at the machine, and fell in love with its simplicity. "I could sell a hundred of those in no time," he boasted. The President thought he was crazy and told him so. But Zion decided to try it out for a few weeks, went down to Providence and sold the first man he saw, then went to New Bedford and Fall River and repeated the process. In New York state he sold thirty-five machines, and during the next three hundred days, ran up a grand total of 300 machines which netted him $15,000 in commissions. Although he still didn't know the first thing about locks, Zion decided he was cut out for the business.

Not till years later did Zion's sister-in-law confess her part in the plot. "The president of the lock company promised me a pearl necklace if I could find anyone who could sell key-cutting machines. I looked around, and the first one I thought of was Barney. I never dreamed anything like *this* would come of it."

The Majestic Lock Company, of which Barney Zion is President, Sales Manager, Chief Mechanic, and often switchboard operator, today grosses over $200,000 a year. Zion, with the help of his wife and an elderly man who specializes in trunk keys, does all the work. He tries to discourage people from leaving things with him for repair, because as he says, "We have more business now than we have a right to have." Recalling his early

days as a salesman, Zion says, "I haven't done any selling in years. I've got three times as much business as I can handle." During the period since 1931, when the Majestic Lock Company was founded, Barney has grown so close to the mechanical side of the trade that he has memorized the code numbers of all important kinds of locks, and he'll tell you, shaking his head solemnly, "Frankly, I don't know how I do it."

Ninety per cent of Zion's business is war work. When he looks at a Navy cruiser or destroyer, he can make a good bet that his equipment is used on board. No believer in false modesty, he has tacked this sign on his office wall: "Nothing is too good for the Navy!—Every ship launched in 1941-42 and those to be launched in 1943-44 will be equipped for key cutting by Majestic." In order to help sailors operate his key cutters, Zion has written a pamphlet of instructions which goes with every order. The Army also orders thousands of locks and keys from Majestic—either in mass quantity to equip whole camps or airfields, or to replace keys taken away by forgetful soldiers who have moved on. War plants are among his largest customers.

The large amount of war work done by the Majestic Lock Company is constantly being interrupted by phone calls from desperate people, who plead with Zion as if he were the only person in the world who could help them—as indeed he often is. For a run of the mill example, a phone call came in one afternoon late from a man on Staten Island. He needed two keys for a drawer lock in a hurry—and he gave Barney the name and number of the lock. Barney looked up this data in a black loose-leaf notebook—in which neat lists of practically all the locks in the world are typed up and coded with cross references. Barney ran his finger down the pages—found two sets of numbers. One set told him the number of the proper key blank, which he selected from a complete set of blanks he has filed along the wall. The other set consisted of five numbers, representing the five cuts to be made in the key. Then Barney selected two circular steel plates, marked especially for this type of key, and fitted them into the key cutting machine.

The uninformed might think that cutting a key this way required nothing short of wizardry, but watching Barney, it all seems very simple. He sets a pointer on the first plate to the number one mark. That means the machine will cut the first tooth of the key. The depth of that cut comes from the first numeral of the code number, which is, say, 42003. He sets the other plate at the four mark—and automatically the machine cuts out the proper notch. Then for cut number two he sets both pointers at two—and so on, until he has ground out all five cuts. The whole process, including a duplicate key, takes him less than two minutes, and there is never the slightest doubt

[*Continued on page* 142]

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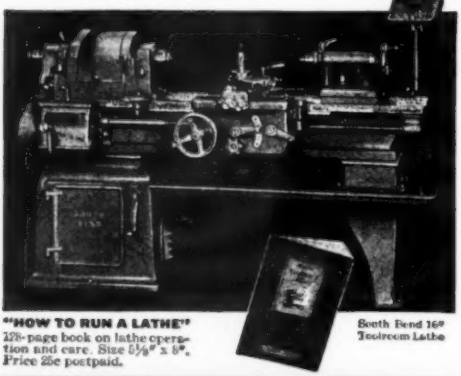

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Facials For Furniture

[*Continued from page* 74]

camel's-hair or red sable brushes, three-eighths to three-quarters of an inch long, and with the hairs forming a *perfect point*. This latter is very important as you cannot possibly get clean strokes if there are any straggly hairs sticking sidewise out of the brush. It's also best to have a separate brush for each color, so you don't have to waste time washing brushes when changing from one color to another. When you're through painting, wash the brushes in soap and warm (not hot) water, reshape the points while wet, and set aside until needed.

That's about the whole story, so just study Peter Hunt's basic brush strokes and design build-ups for awhile. Practice a bit on an old chair and you'll be ready to perform some minor miracles around the house. You may not get orders for your work from stores, manufacturers and individuals all over the United States, as Peter does, but you'll have a lot of fun, resurrect a lot of buried bureaus and probably have all your friends pestering the life out of you. You'll be in good company too, with Peter Hunt style pieces on the premises—his work graces the homes of many celebrities, including Lowell Thomas, Lily Pons, Helena Rubenstein and Gypsy Rose Lee!

Peter Hunt's Workbook, giving the complete story of his furniture and home decoration ideas, will be published this Fall by Ziff-Davis Publishing Co.

Open Sesame

[*Continued from page* 141]

about whether the keys will work. If you look at all skeptical, Barney will hand you a lock and urge you to go ahead and try for yourself.

He explains his reputation as a result of the inadequacy of locksmiths in general, whom he holds in low esteem. "There's not a single school of locksmithing in the whole country," he'll tell you heatedly, "and most of the people who are locksmiths don't know much about it, and haven't any equipment anyway." He himself claims to have the best in the country; though like most of the others, he started out with about twenty dollars in capital. Now he has just about everything, including a particularly prized machine which he designed himself. It's a device for cutting the teeth in circular steel discs, which in turn cut keys. Barney sometimes stays after hours till three or four in the morning, marking off the 220 teeth on the edge of a steel disc.

Barney's most spectacular invention, however, and his neatest trick of lock opening, is what he calls the Lockaid Gun. Invented in 1931 by Barney and a couple of mechanically minded friends, it looks like any kid's toy pistol, except that it has a thin needle in place of the barrel. By putting the needle into the lock and squeezing the trigger five or six times, you can open any

lock almost as quickly as you can say "Jimmy Valentine"—that is, if you're a G-man or a Canadian Mountie, or can convince the police that you should have a permit to own one.

People before Barney had thought up the general idea of the Lockaid Gun, which is to force the delicate pins which are inside every lock back against their springs. Barney contributed to the theoretical development of the gun something of which he speaks mysteriously as "control." That is a way of overcoming the fact that since some of the little springs are tighter and stronger than others, the gun, to adapt itself to all locks, must have, as it were, a sense of touch. That is what Zion gave it.

One cold dark morning last winter the Zion household was wakened at one a.m. by a call from the police. No questions asked; Barney got up and dressed for an emergency. In a few seconds a police car with motorcycle escort arrived at his Washington Heights home, and he was guardedly whisked downtown, and through the Holland Tunnel to a Jersey pier, which was feverish with loading cranes and dock workers straining to beat the deadline under the floodlights' glare. Alongside was a Russian ship. Barney was taken on board, where they told him the purpose of his mission. The quantities of food, weapons, and war material which this ship was taking to the Russian front had been assembled, checked and rechecked. Just one thing was found missing That was the key to the spare tire of an army staff car.

Barney of course had no trouble in making the key, since he is the author of a complete code book of car keys, for all makes since 1924. The hardest part, he says, was searching through the rows and rows of tarpaulins to find the right car. Even so, he had the job done and was in bed by four o'clock—well before the ship started its voyage home.

Recently Zion got a somewhat larger order—the Western Electric Company asked him to make 7,000 keys in just ten days. Supplied only with a code number of each lock, Zion finished under the deadline. Out of 7,000 only three keys didn't fit. Bothered by this percentage of error, Zion, who has unlimited faith in his own accuracy, told the Western Electric people that the fault was in their locks. "And by God," he says, "when they inspected those three locks, they discovered I was right."

For many years lock companies would send Zion their new locks and dare him to pick them. Zion won every time. After a long string of uninterrupted successes, he got bored and decided to invent a lock that even he couldn't pick. For once, Barney Zion failed.

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Mata Hari With A Glass Eye

[*Continued from page 79*]

referring to standard references such as Jane's Fighting Ships.

Third phase photo interpretation is that of special studies. A great deal of this has been done over Europe, where the best examples include industrial studies. The British have studied railroad yards daily, counting the locomotives and freight cars and itemizing the latter as to type. By pooling this information gathered from aerial photographs of key European yards, the photo interpretation people actually have been able to tell in what direction the traffic is heading and at what points the Nazis are concentrating men and materiel.

This type of work is considered highly specialized. The photographs are studied by industrial specialists who consider the size of photographed plants, e.g. the number and activity of blast furnaces at a steel plant, and from this and other data estimate the probable production of that plant. They are able to tell how enemy aircraft production is holding up by studying photographs of known European aircraft manufacturing plants. The studies of damage done after raids by the bombers is most revealing, since the condition of buildings, indications of street traffic, fire damage and bomb c aters show up plainly when one learns what to look for.

Photographic mapping can be called a fourth phase of aerial photography. The mapping films come back to the same laboratory in the field that is handling other aerial photographs. In the first place the planning office decides what scale map should be made, based on the outfit requesting the map, and the officer in charge knows what lineal and lateral distances the camera will cover at certain altitudes. The aerial photographic method is an economical way of getting an up-to-date map of an area. Knowing the desired map scale the photographic officer is able to lay out flight lines on existing large-scale charts which are sent along with the photographic plane to use. Usually, an alternate altitude for flying the map is selected and flight lines laid in another color on the same chart. Quite often the photographic plane will encounter clouds at one altitude, but with the alternate, can still perform the mapping mission.

The plane goes over the area to be mapped taking photographs with a 60% lineal overlap. At the end of one run on the area to be mapped, he wheels about and comes back making a 40% lateral overlap on the previous photographs. This wide margin of duplication is allowed to take care of errors that wind and other conditions might cause. The flight lines are laid out over prominent landmarks to guide the pilot and also to aid in laying up the photo-mosaics later. These successive flight lines over any given territory are continued until all the area is covered, whether it is a small atoll or an entire continent.

For photo interpretation purposes we like a good scale. The scale is determined by a simple equation in which the scale equals the focal length of the camera in proportion to the altitude. With a 12-inch camera photographing at 15,000 feet the scale is one to 15,000. The same scale is possible at 30,000 feet with a 24-inch focal length camera.

Stereoscopic viewing, which gives the three-dimensional effect to a pair of photographs, is effective in detecting much of the camouflage that uses paint on a flat surface, or nets and other structural devices to break up shadows of buildings.

My duties while in the New Hebrides were typical. For ten days I lived there with the Army. We had two standard Army pyramidal tents—more or less water-proof and set up over wood decks. Our location was close to operations and we were connected by direct telephone to them for instant information if a strike was planned against the enemy.

Usually we would arrive at the field before the plane crew, but sometimes they'd already be on hand, sprawled under one wing, smoking and waiting to warm up the planes. Last to arrive were the pilots who had just come from the briefing tent where they had learned their mission and probably had seen prints of yesterday's pictures taken by other planes in their outfit. With these pictures of their target to aid them, they were ready to be off for a day's work against the enemy. Usually before returning to my sack for a few hours' more shut-eye, I'd stand by to watch our "big friends" take off. As a non-flyer I always got a kick out of watching the great planes tear down the coral runway, lift gracefully and disappear in the waning morning darkness.

With the cameramen in their planes my major duties were completed until they returned in late afternoon, when again I would careen from bunker to bunker in my jeep, picking up photographers and cameras preparatory to sending men and camera magazines back to the seaplane tender's photo lab for processing and interpretation of the pictures.

We were bombed often on Guadalcanal and got quite used to leaping into foxholes, many of them originally made by the Japanese but enlarged by us so no strategic portions of ourselves would be left above ground. The Japanese kept trying to take the island away from us while I was there, but they didn't get it. A few Marines and the Army attended to that, but the men in the photography units were right in there boosting the project along. Better pictures mean better bombings, and the better our pictures the less there'll be left of Tokyo when the showdown comes.

More than 70 species of sharks are found in North American waters.

No Margin For Error

[*Continued from page* 37]

confusing the defense. Should the pilots fail in this, there would be no second crack at the target; the Germans would certainly move the vital documents to another secret hiding place, or else equip the house with enough anti-aircraft defenses as to make a repeat attack impractical.

The time of the attempt had to be gauged so as to reduce the danger to civilians in the area to the absolute minimum. The weather had to be chosen to give the crews a visibility of at least six miles.

When all these factors had been mastered and integrated, the six Mosquitoes, which for combined speed, durability and versatility have no equal in the air, roared off from their base somewhere in England and headed in broadest daylight across the channel coast toward Holland, toward The Hague, toward the Scheveningsche Weg, and toward that certain house.

Over Holland the Mosquitoes ran into difficulties. The Germans had flooded the fields, and consequently important landmarks had been altered or had disappeared. But Commander Bateson and his cohorts quickly orientated themselves and flew on. They reached The Hague and circled the city several times to find the house. Once it was definitely spotted the Mosquitoes went in at roof-top height, and the fun began.

This is how Commander Bateson afterwards told the story in his own words:

"I came down and went in for what was a perfect practice bombing run. The building was a sort of five-story affair; I should say about 90 feet high. We bombed from below that height, from about 50 feet.

"I was a bit worried about the wing-tip hitting the spire of the Peace Palace, but it was all right.

"I could not see what happened myself, but my No. 2 could follow my bombs all the way down, and two went through the front door and two banged through the windows on either side of the doorway.

"I was a bit worried about the two wing bombs in case they hit the houses next door. But we all bombed dead on, and the incendiaries did their stuff beautifully. By the time Nos. 5 and 6 came along the building just was not there.

"As we were bombing more or less horizontally, these bombs went through the gap and landed in a barracks just behind the house. So they were not wasted.

"We got out with hardly a shot being fired. They hadn't a clue about what was happening. We had Spitfires waiting to escort us home and they picked us up dead on time.

[*Continued on page* 146]

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No Margin For Error

[*Continued from page* 145]

"Photographs taken later are amazing. The house is absolutely demolished. It is just a heap of rubble.

"There were only a few tiles off an adjoining building, and there cannot be many important documents left in the house at The Hague."

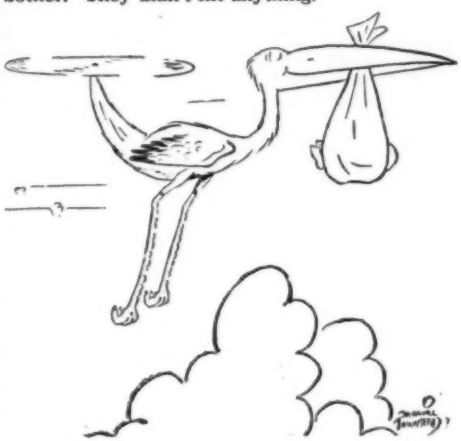
There the German sentry stood in the peaceful sunshine, minding his own business like any well-behaved krauthead on duty, when a formation of Mosquitoes began flying straight for the top of his helmet. What is a warrior of the New Order supposed to do under those circumstances? The Mosquito men saw him throw down his gun and get the hell out of there pronto.

Nearby the target-house was the barracks mentioned by Commander Bateson. There were troops parading there, and a football game was in progress, indicating with what complete surprise the Mosquitoes had managed to approach their objective. The football game and the parade disintegrated into wild scrambles for cover on the part of the athletes and the paraders.

These low-comedy episodes were, of course, merely sidelights of the grim business that was going on above. Two minutes after Commander Bateson had made his run and his bombs had had time to explode, Squadron Leader C. W. M. Newman led the second pair of Mosquitoes in. By this time, the house was partly obscured by smoke, but incendiaries were dropped across it.

Then Flight Lieutenant V. A. Hester and a Dutch pilot went in with more fire bombs and delayed-action high explosives. The Dutchman had the only bad luck of the trip. He made two runs on the house, but his bombs hung up and he couldn't get them away.

Only after the damage had been completely done and the mission successfully carried out did the Germans get into action. Some spasmodic flak came up as the Mosquitoes headed for home. The Germans could have saved themselves the bother. They didn't hit anything.



Cycles Predict The Future

[*Continued from page 47*]

more or less evenly on its expected course through the War of 1812, the Civil War, Spanish-American, and World War I.

With the building cycle indicating a steady downward trend until 1952, what happens to the anticipated postwar building boom? The gloomiest guess might be that the war will not be fully concluded until the 1950's, preceding the minor depression around 1952 when an upturn in business and building cycles is anticipated. It is more probable, however, that the nation will be much poorer in real income and buying power than many people expect. The staggering load of the national debt, heavy taxation, and the attrition of war may well impose a burden upon the country which will take years to disperse. Dream homes, though they live up fully to manufacturer's promises, may find fewer people able to buy them than is hoped for.

A striking study of cycle trends in one important business—an example which hardly justifies one in regarding the next few years with glowing optimism—is given by Edward R. Dewey, Director of the Foundation For The Study Of Cycles, in his valuable and informative booklet, "Putting Cycles To Work in Science and Industry."

The study is that of sales of a large public utility company. The probable cyclical course of the company's business for the next 20 years is charted by combining two characteristic rhythms, of 7½ and 18⅓ years, with the observed trend of the firm's business (i.e., the rate of increase or decrease through the years) and arriving at the probable curve of its activities during the next two decades.

As a glance at the diagram will show, the sales of this company may be expected to begin dropping off toward the end of 1944. Nor is it a temporary decline that is apparently in prospect. The course continues steadily downward until 1948, then hits a plateau of depression, and instead of climbing out of it, starts another decline in 1952 and slumps slowly until 1955 when for the first time in a decade an upward trend is indicated!

Note that if the curve follows its projected course, in 1948 it not only reaches a level lower than that of the lamented 1930's, but stays there for 3½ years—nearly twice as long as was required by this company to come out of the 1933-34 slump. Even then things get worse before they get better. From 1952 through 1955, sales scrape along at a level which makes 1933 look like good business. Not for at least 18 years can this company look for a level of sales as high as it enjoys in this year of 1944.

We get a picture of depression, more drastic than that of the bank-closing era of Roosevelt's first inauguration, lasting for about seven years, which is not far from the length of the major

[*Continued on page 148*]

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Cycles Predict The Future

[*Continued from page* 147]

business cycle. True, this probable course is plotted from the records of a single business, but that business, being a large public utility, is a fairly sensitive barometer of general conditions. It should be emphasized that the projected curve is not arrived at through a poll of public opinion, studies of international trade, or any kind of wishful thinking, but through a mathematical analysis of ups and downs that have been continuously operating in this business and presumably will continue their characteristic patterns.

The essential value of such a chart is to enable executives to plan for what is apparently ahead. Among other things, it suggests, as Mr. Dewey has pointed out, that 1945 and 1946 are years in which employees should be taken on temporarily instead of permanently, and that in 1946 and 1947 the process of weeding out employees in anticipation of depression should be well under way. When the downturn definitely arrives after 1946, the company's surplus plant and equipment might well be scrapped, since some 18 years may elapse before it is needed again, and costly carrying charges for two decades might profitably be avoided.

For those of us who are workers rather than employers, the prospect of unemployment after 1947 which might be read into the above figures is alarming. Do such studies indicate that many of our costly war plants, now running on 24-hour production, will be junked? Will returning veterans cause widespread readjustments in the labor market? Will the nation's real income drop? This war is the costliest in history and the nations concerned must eventually pick up the tab—will it be paid for by crushing taxation which will depress purchasing power for many years?

Such factors, vital though they are, play no part in projecting the course of cycles into the future. The very essence of cycles, insofar as predictability is concerned, lies in their measurable rhythms and periodicities. The cycle student does not project them by trying to balance the multifold factors that may cause them; rather, he analyzes the way they have ticked off in the past in order to set the clock for tomorrow.

Studies of a single business can hardly be relied upon to inspire unalloyed pessimism about the future. There are numerous other cycle studies, however, especially those of Dr. Raymond H. Wheeler of the University of Kansas, which indicate that the world we are coming to will in many ways be a most upset and disturbing world.

The new setup of a belligerent world when peace comes, changing roles of government, relations between labor and capital, situation of minorities, federal regulation of business, etc., as forecast by cycles that have been operating at least 1,500 years, will be presented in the concluding article of this series in the next issue of MECHANIX ILLUSTRATED.

Miracles To Come

[*Continued from page* 51]

it can be used to detect invisible reflected light as well as visible light."

Military officers would have, then, an electronic method of ripping away the shield of darkness, observing on a screen the secret movements of an enemy miles away in the dead of night.

Vexing problems have engaged other winners in Science Talent searches. For instance, magnetic and gyroscopic compasses are relatively useless at the earth's poles, yet many of the shortest routes in tomorrow's air travel must pass over the North Pole.

"It would seem that aerial navigation of the future must depend upon the perfection of an instrument independent of the earth's magnetic or geographical poles," wrote essayist Wanda Wojciechowski of Bridgeport, Conn. "In such an instrument, observations of the sun may be used. For example, the image of the sun is projected on a ground glass screen when the aircraft is flying on a given course. A rotation of the optical system about a vertical axis once in 24 hours provides that the image is maintained on the screen unless a change of course is made. In practice, the pilot would set the sun compass to a desired course and turn the aircraft until the sun appeared on the screen; he would then steer by the image."

Many of the young scientists are concerned with the basic problem of power sources. Charles Sargent of Lakeville, Conn., sees engineers transmitting electricity at 1,000,000 volts, "a process probably requiring very smooth wires several inches in diameter. Power would become marketable within a radius of 1,000 miles from a dam site."

Suppose we eventually have ample quantities of U-235, the isotope of uranium which has already yielded atomic energy—can we harness it? Hillman Dickinson of Independence, Mo., tells how it could be done:

"If water were released over or through U-235, it would be instantly transformed to steam. This could be passed over a turbine and on to a condenser and back, thus producing a continuously operating motor until repair was needed or the supply of U-235 used up. Regulation would be easy, as one would only need to cut off the supply of water to stop the motor."

Joseph Milton Fox of Philadelphia, Pa., believes that the problem of tapping the internal heat of the earth is not insurmountable.

"Tesla actually devised a plan for a terrestrial power plant in which water circulates to the bottom of a deep shaft sunk into the interior of the earth, becomes heated, and finally returns to the surface as steam, ready to produce electricity and to drive man's machines," he writes. "One community in Sonora County, California, is now using volcanic steam from a nearby source to generate all the electricity it needs for local use. In the

[*Continued on page* 150]

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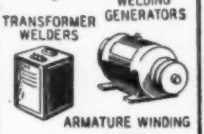

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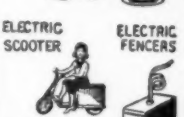

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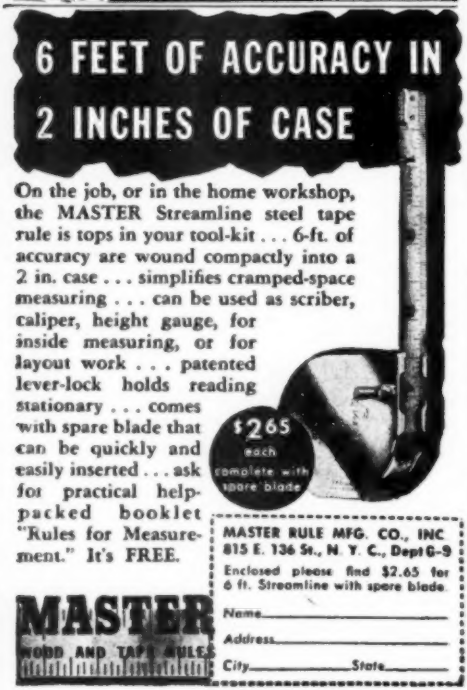
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Miracles To Come

[*Continued from page* 149]

very near future, then, large areas abounding in subterranean activity, such as regions of Alaska, sections of Iceland and New Zealand, Yellowstone Park in the U. S., etc., may become sites for power plants."

Sound waves too high to hear are considered of great promise in medicine by Henry Kohl of Exeter, N. H. He notes the development of "a method of separating active, powerful typhoid germs from inactive, harmless ones by a supersonic note produced by an electric oscillator. This method of separating bacteria promises to be of great value in medicine in the future if it can be developed so that any two types of bacteria can be separated." Supersonic waves are deadly to many types of germs—tomorrow, instead of applying an antiseptic to an injury, you may merely expose the wound to supersonic bombardment.

Daring indeed is the scientific imagination of Joan Ronder, New Rochelle, N. Y., who predicts new kidneys, lungs, and other organs manufactured to order.

"In order to manufacture living cells," this young biochemist warns, "we will have to create separately the structural proteins, the microscopic particulates, the interparticulate liquid, and the essential complex structures of the nucleus. After combining these into a cell, I think it will be necessary to devise an electrical current to set the life processes in motion.

"Once the more complex nerve, muscle, and blood cells can be created, I do not believe that forming an organ from these cells will be the next-to-impossible step it sounds. Carrel found that when skin cells, white corpuscles, and fibrous tissues were placed together, they proceeded to form an organ of their own, which, of course, remained small because of lack of a circulatory system.

"Given the blood cells lacking, and grown under strict control, the natural tendency of cells to unite for mutual aid and convenience can be utilized in the laboratory to form artificial kidneys, lungs, and other structures. These artificially produced organs will greatly advance medicine and surgery, for a diseased organ of the body will then not mean death or disability if such an organ can be exchanged for a new, perfect, and, no doubt, more 'streamlined' one. Such organs will be kept alive by being constantly bathed in blood serum in a setup similar to Lindbergh's perfusion pump."

Food researchers may even succeed in bestowing immortality upon human beings, in the opinion of Bernard Strehler of Johnstown, Pa. Commenting upon calcium deposits in the tissues that accompany ageing, he remarks that "the inquiring mind asks what the cause of this calciferous deposit is, and how it can be removed. These questions have not as yet been answered, but it is possible that some 'elixir' vitamin will catalyze our food so perfectly as to prevent useless products from collecting in the tissues."

Miracles To Come

Practically all fields of science turn out to be relatively unexplored when one reads the blueprints that hard-headed men of research have drawn for the future. David Sarnoff, President of Radio Corporation of America, has forecast the ultimate in personal radio:

"We have much to learn about the micro-waves, in which is wrapped up the new world of individualized radio. Tiny electron tubes may make it possible to design radio receivers and transmitters no larger than a fountain pen, a cigarette case, a billfold or a lady's powder box. Some day people may carry television screens on their wrists, as they now carry watches. For, as the useful spectrum of radio approaches the frontiers of light, the apparatus will become simpler and more compact.

"Research men are exploring supersonic vibrations, far above the range of the human ear. The use of these ultra-sonics in chemistry may open a field in which high-intensity sound accelerates chemical reactions. Experiments also indicate important possibilities in many other fields, including underwater communication, emulsification of liquids and precipitation of dust from the air."

Since every raindrop is formed around a minute particle of dust, we may some day be able to prevent rain by clearing the atmosphere of dust with supersonic waves, letting storms pass on where they will do more good.

Agricultural research is almost an unknown land. Dr. E. C. Auchter of the U. S. Department of Agriculture has outlined some possibilities. A mold yields the lifesaving drug, penicillin; certain palatable yeasts now provide foods richer in protein than beefsteak. But there are thousands of unidentified micro-organisms which may yield drugs and foods more wonderful than these. And waste residues of farm crops can provide raw materials for great new industries as yet not even imagined.

"I need only point out that our knowledge of such substances as starch, proteins, lignin, hemicellulose, enzymes, hormones and vitamins is still hardly more than rudimentary," says Dr. Auchter.

When the myriad paths of scientific research, now dimly seen, are followed to the goals, the shape of the world to come will probably surprise even the scientists. We haven't seen anything yet!

The celestial navigator trainer, used by the Army to train aircraft crews, is a plane fuselage suspended in a tower in a framework; it simulates flying conditions and can do anything a real plane can do except actually fly, loop-the-loop, or crash.

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What Can Air Power Do?

[*Continued from page 54*]

sacrifice bomb load for the gasoline necessary to get it there.

The third great truth to appear was this: The airplane is a weapon of offensive warfare; there is no such thing as "airtight" defense against air attack. This truth is best evidenced by the frequency of Nazi air raids on London and on the invasion ports of England—these attacks mounted despite the fact that England's little island is virtually alive with interceptor planes, airplane detection devices and anti-aircraft protection. This fact was more dramatically punched home at Gela Bay, in Italy, where, despite our mastery of the air, Nazi bombers were able to strike in a sneak raid which sank some 18 Allied vessels.

This truth is perhaps the most frightening of all the newly learned truths about air power. Sea power and land power are at the same time defensive and offensive weapons. In the air there seems to have been developed up to this time no *certain* defense against lightning raids.

This fact conjures up the picture of a vast air force in the hands of some future international bandit striking without warning from the skies in an entirely new type of warfare, staged on a much greater scale than was the Japanese attack at Pearl Harbor. It is a danger which must be considered seriously when we are once more at peace. Our navy has heretofore always been our first line of defense. Naval defense against air attack has been vastly improved.

Yet, in the future, we will always be in danger of some much greater Pearl Harbor. Because of the lack of absolute defense against air attack, America's shores will have to be fortified in the future on a scale heretofore undreamed of. Many of America's vital industries will have to be bomb-proofed. America will never again be able to maintain a token army, as she has done in the past.

Summing up the meaning of this particular truth about the new air power: No enemy will be able to conquer us by a sudden aerial blow alone; but an enemy might conceivably be able with one blow to cripple our naval defenses and land a force on our shores, unless we greatly increase our shore defenses and continue to maintain a large standing army.

This one truth of the new air power, it is plain, is going to change the face of America, its economy and its policies for all time.

Such are the principal limitations of air power as we have learned them up to date: (1) Air power is not decisive and will not become a decisive weapon until it is possible to apply it continuously; (2) Air power is not self-contained and is dependent on bases and surface supplies; (3) Air power is an offensive weapon and against it there is no certain defense.

What are the positive aspects of air power, then? We have learned it can be applied in four principal ways:

What Can Air Power Do?

(1) As a strategic instrument of destruction. It may be used to weaken a nation by bombing its industries, forcing the populations of its principal cities to disperse, lowering the efficiency of its internal lines of supply, blowing up its power plants, mines, etc.

(2) As a tactical arm, in support of land or sea weapons. Our bombers, in this role, have become longe range artillery, to be used to destroy enemy supply dumps, railroads, troop or sea concentrations; and thus prepare the way for a naval force or a land force to move in and come to close grips with the enemy.

(3) As a third dimensional branch of infantry attack. Until this war, armies could move in only two dimensions. They could attack head on or they could go *around* an enemy army. Now they can go *over* an enemy force and land in his rear, by means of paratroops or glider troops. At Crete, the Nazis jumped over the British Navy. The first large-scale applications of this third-dimensional method of attack on land were MacArthur's paratroop assault at Wewak, New Guinea, the Wingate-Cochran glider attack behind Jap lines in Burma, and, most spectacular of all, the Normandy invasion. A new factor, then, has been added to the science of tactics and much of the literature on surface warfare has become obsolete.

(4) In a limited degree, as a means of supply. Air power has been used to supply Chennault's forces in China, for instance, But, as Hanson Baldwin has so ably pointed out, air power will not be able to supply its own needs for many years to come. One hundred thousand tons of cargo can be transported from America to Australia in one month by 44 merchant ships with crews totaling 3,200 men. To transport the same amount of cargo by air would require 10,000 transport planes with crews totaling 120,000 men. The cargo vessels would consume 165,000 barrels of fuel. The planes would consume 9,000,000 barrels of fuel.

But the most far-reaching fact about air power to emerge from this war is the following fact:

Only a nation with a huge industrial capacity and vast raw materials can support a true air striking force.

There are in the world today only two nations capable of maintaining a large-scale air force in a large-scale air war. Those two are America and Russia.

Russia, engrossed in her surface war with the Nazis, has rejected air power. She has lagged far behind in air production, in air experience, in air training.

America, largely by accident, finds herself today the King of the Air, with a production of over 9,000 military planes a month, with a vast pool of trained airmen and with a great backlog of aerial "know-how."

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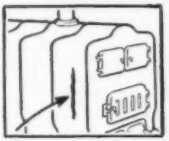

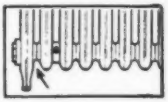

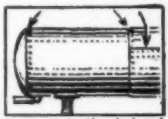

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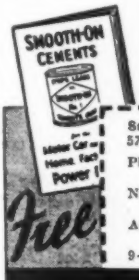

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Editor's Workbench Chips

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The Winners!

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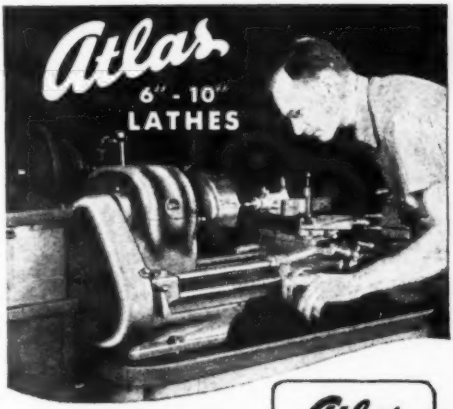
ELLEZELLES	3055
LEES	1411



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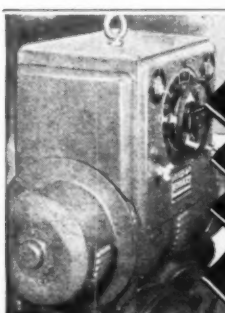

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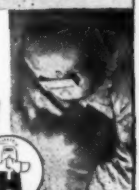

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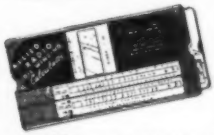

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[*Continued from page 12*]

pose that the gasket is not compressed fully. Then, the high pressure gas would flow into the first annular groove. If the high pressure line is 800 lbs. to the square inch, this same pressure would now be communicated to the second annular groove, which because of its thin wall would break down and so on. Consequently, it is our belief, that you would get a series of leaks and breakdowns.

In a large volume called THE GROWTH OF INDUSTRIAL ART, "reproduced and printed in pursuance of act of Congress, March 3, 1886, and acts supplementary thereto" and printed by the Government Printing Office, you will find an illustration of a keyway style of screw and screw driver. This item was patented between the years 1823 and 1856. The illustration appears on page 133 of that volume. We do not believe that you will be able to do anything with this screw driver or any other screw driver of a similar style.

If you will make a small cardboard model of your motor-driven hacksaw, you will find that this will not function as described. The hacksaw blade will vibrate but it will not saw back and forth, unless you have some sort of a guide along which the saw will run. This is not illustrated in your sketches.

Collapsible Tube Closures

R. E. Salvesen, Forest City, Iowa, submits several designs for caps for collapsible tubes and asks some questions about them.

ANSWER: *It is perfectly true that a self-sealing closure for collapsible tubes is wanted; such a closure must be fool-proof, must be manufactured cheaply, must be applied easily, must remain clean, and must not gum.*

The closure illustrated in your Fig. 1 has been used for milk bottles and was available in 5 & 10-cent stores. It has not been employed on collapsible tubes. Neither is it suitable for such tubes, because it does not close tightly enough and any pressure on the tube itself would eject the contents alongside of the closure.

It is very likely that the closure of Fig. 2 is not used on collapsible tubes for the obvious reason, which can be seen on the sides of the oil cans which use this type of closure. During the shearing action, and particularly when there is a paste in the tube, some of the paste will be cut off by the cap and remain on the surface of the cap, leaving it in an unsanitary condition and certainly unsightly. Most automatic tube closures do a very unsatisfactory shearing job. This is the one flea in the ointment, so to speak.

The Ukraine has the densest railroad network of any part of the Soviet Union.

The U. S. Army's first airplane pilot was Frank P. Lahm, now a general and First Army Air Officer at Governor's Island, N. Y.

The Winners!

[*Continued from page 44*]

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[*Continued on page 158*]

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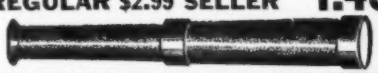

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Popular Patents

Rear-Steering, All-Wheel-Drive Tractor

A four-wheel-drive tractor that steers with its rear wheels, so that each rear wheel always follows exactly in the track made by its fore wheel, is the interesting farm machine on which Leon Champion of Marne, Mich., has taken out patent 2,349,141.

In Mr. Champion's tractor the engine is forward, as in conventional designs. The transmission gear box is directly over the center of the chassis, with a multiple chain drive to the master gear of the two drive shafts. The forward wheels, being fixed, offer no particular novelty. The rear

"Not bad for my first solo shopping trip!"

wheels can be swung through a wide lateral angle, at the end of their pivoted drive shaft, their traverse being controlled through an arc-shaped channel-steel member at the rear of the chassis.

The inventor states that this tractor can be built out of standard automobile parts, even from "obsoleted" cars.

Not Photo-Finish, But Photo-Whole-Race

Less serious and workaday is the invention covered by patent 2,348,841, issued to R. A. Oswald of San Mateo, Calif. It is a device which ambitiously undertakes to make motion pictures of an entire horse-race, instead of merely the by now conventional "photo-finish" shots.

It consists essentially of a motor car mounted on flanged wheels, bearing a motion picture camera at the top of a suitably tall shaft to give sufficient command; the shaft also contains a periscope for the use of the photographer who rides in the car. The whole contrivance runs on an elliptical rail-

Popular Patents

way just inside the track, so that the car can keep out in front of the race, in good position to make a complete record of its whole progress, for use in settling disputed points.

The inventor makes no mention of other possible uses, but it is obvious that if arrangements of this kind are actually installed at race tracks, newsreel men will not long overlook them.

Unconventional Power Plant For Planes

Also in the hands of the Alien Property Custodian is patent 2,348,792, granted to the well-known German designer Claude Dornier of Friedrichshaven.

Herr Dornier, who has long been known as a bold, unconventional experimentalist, here undertakes to meet the problems imposed upon aircraft propelling plants by anticipated ultra-high speeds, in the neighborhood of the velocity of sound. Each nacelle, as he visions it, is to have two engines. The forward one will drive a more or less conventional "puller" propeller. The after engine will drive an ultra-high-speed fan or blower, which will pull air in through a series of slots and expel it through a second series of openings immediately to the rear. It appears to be an effort to obtain an effect like that of jet propulsion through mechanical means only.

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1. Buy only what you *absolutely need*. Make the article you have last longer by proper care. Avoid waste.
2. Pay no more than ceiling prices. Buy rationed goods only by exchanging stamps. (Rationing and ceiling prices are for *your protection*.)
3. Pay willingly any taxes that your country needs. (They are the cheapest way of paying for the war.)
4. Pay off your old debts—avoid making new ones.
5. Don't ask more money for the goods you sell or for the work you do. Higher prices come out of everybody's pocket—including *yours*.
6. Establish and maintain a savings account: maintain adequate life insurance.
7. Buy all the War Bonds you can—and hold 'em!

Use it up . . . Wear it out . . . Make it do . . . Or do without

A United States War message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by this magazine in cooperation with the Magazine Publishers of America.